

S800 I/O

General Information and Installation

User's Guide

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Chapter 1 Introduction

The S800 I/O is distributed modular I/O which communicates with numerous controllers over a Advant Fieldbus 100 (AF 100), PROFIBUS-DP or directly. The S800 I/O provides easy installation of the I/O modules and process cabling. It is highly modularized and flexible so that I/O modules can be combined to suit many applications. The S800 I/O can be mounted in many configurations to fit most requirements.

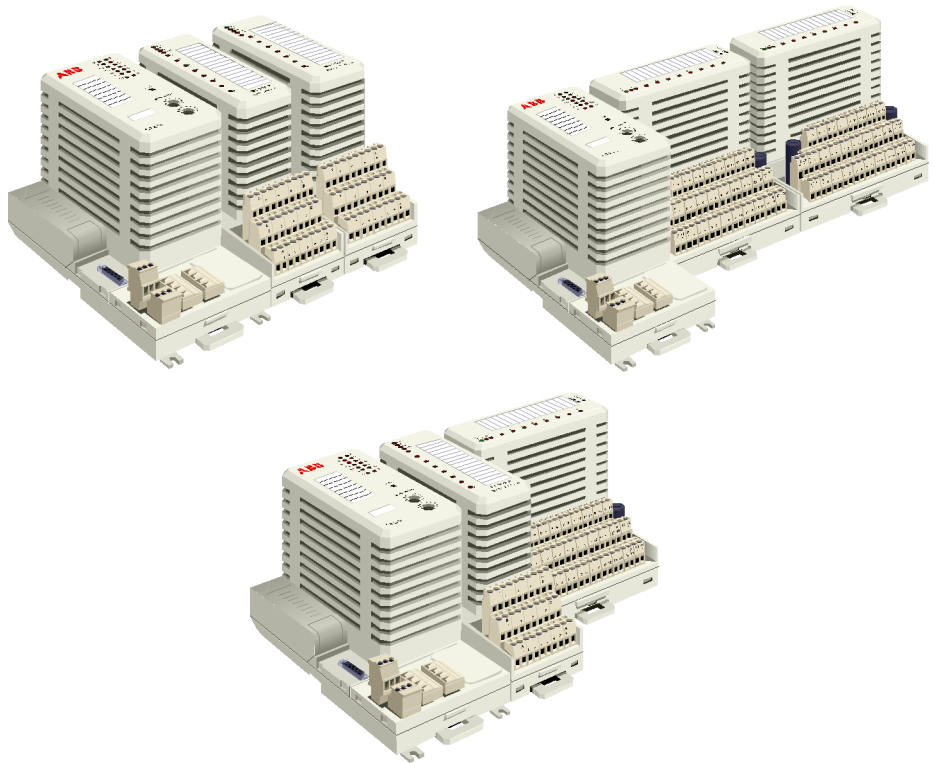


Figure 1-1. S800 I/O Fieldbus Communication Interface with an I/O Module on Compact and Extended MTUs

1.1 About This Book

This book provides a general description of the S800 I/O and reference information about equipment common to all types of installations, for example power supplies and Modulebus components. It provides overall instructions for site planning and installation, start-up and shutdown procedures, and information regarding capacity and performance. This book is not intended to be the sole source of instruction for the S800 I/O system.

This chapter provides introductory and background information including guidelines how to find information in the manual related documentation and a product and functional overview of the S800 I/O.

Chapter 2 guides in installation of the I/O system including:

- Guidelines for planning the installation of the product.
- Information how to set up the equipment. It includes safety regulations, handling and unpacking instructions, inspection and assembly procedures, cable routing and connections, setup procedures, etc. Common instructions as well as instructions directed to specific subsystem are given. Activities prior to power up are described.
- Shut-down procedures. In addition to safety regulations, the basic shut down procedures are given. You should know how to shut-down the product if initial power up has problems.
- Start-up procedures. In the set-up section the conditions and the preparation for start are discussed, and here you can find basic power up procedures, such as, how to apply power to and initialize the I/O system.
- Product Verification. Initial determination that the I/O is functional.

Chapter 3 will give you the information needed to obtain the desired function. The main information is structured as follow:

- Design considerations and guidelines are given.
- Capacity and performance.

Chapter 4 discusses the different start modes and operating modes of the I/O.

Chapter 5 focus is on fault finding supported by built in diagnostics and use of system status displays in operator station and LEDs on I/O hardware units.

Use of Warning, Caution, Information, and Tip

This publication includes **Warning**, **Caution**, and **Information** where appropriate to point out safety related or other important information. It also includes **Tip** to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:



Warning indicates the presence of a hazard which could result in *personal injury*.



Caution indicates the presence of a hazard which could result in *equipment or property damage*.



Information alerts the reader to pertinent facts and conditions.



Tip indicates advice on, for example, how to design your project or how to use a certain function.

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.



Those people involved in system engineering should attend the applicable system engineering or maintenance courses offered by ABB Automation University.

1.2 Product Overview

The S800 I/O provides easy installation of the I/O modules and process cabling. It is highly modularized and flexible so that the I/O modules can be combined to suit

many applications including Intrinsic Safety Interface. The S800 I/O modules and a Fieldbus Communication Interface (FCI) are combined to form an I/O Station.

The equipment that is used as part of the I/O Station with S800 I/O is presented in Table 1-1.

Table 1-1. I/O Station with S800 I/O Components

Device Type Designator	Function
AI810	8 AI channels (1x8), 0...20mA, 0...10V
AI820	4 AI channels (differential), -20...+20mA, -10...+10V, -5...+5V
AI830	8 AI channel for Resistance Measurements (e.g. Pt 100 sensors)
AI835	7+1 AI channels for Thermocouples or mV Inputs
AI890	8 AI channels (1x8), 0...20mA, I.S. interface
AO810	8 AO channels (1x8), 0...20mA
AO820	4 AO channels galv. isolated (bipolar), -20...+20mA, -10...+10V
AO890	8 AO channels (1x8), 0...20mA, I.S. interface
CI810	Fieldbus Communication Interface (FCI) for Advant Fieldbus 100
CI820	Redundant Fieldbus Communication Interface (FCI) for Advant Fieldbus 100.
CI830	Fieldbus Communication Interface (FCI) for PROFIBUS-DP.
DI810	16 DI channels (2x8), 24V d.c., current sink
DI811	16 DI channels (2x8), 48V d.c., current sink
DI814	16 DI channels (2x8), 24V d.c. current source
DI820	8 DI channels (8x1), 120V a.c./d.c., current sink
DI821	8 DI channels, (8x1) 230V a.c./d.c., current sink
DI830	16 DI channels (2x8) 24V d.c. with sequence of event (SOE) handling, current sink.

Table 1-1. I/O Station with S800 I/O Components (Continued)

Device Type Designator	Function
DI831	16 DI channels (2x8) 48V d.c. with sequence of event (SOE) handling, current sink
DI885	8 DI channels, (1x8) 24/48V d.c. with sequence of event (SOE) handling, current sink
DI890	8 DI channels (8x1), I.S. interface
DO810	16 DO channels (2x8), 24Vd.c.,0.5A, current sourcing
DO814	16 DO channels (2x8), 24Vd.c.,0.5A current sinking
DO815	8 DO channels (2x4), 24V d.c., 2A, current sourcing
DO820	8 DO channels (8x1), Relay, 250V 3A a.c. normally open
DO821	8 DO channels (8x1), Relay, 250V 3A a.c. normally closed
DO890	4 channels (4x1), 12V 40 mA, I.S. interface
DP820	2 channels, pulse count and frequency measurement
TB805	Cable adaptor out module (electrical ModuleBus)
TB806	Cable adaptor in module (electrical ModuleBus)
TB807	Terminator module for electrical ModuleBus
TB810	ModuleBus Optical Port Module 10 Mbit driver, fiber optic connection.
TB811	ModuleBus Optical Port Module 5 Mbit driver, fiber optic connection.
TB815	ModuleBus Interconnection Unit to redundant FCIs (CI820)
TB820	ModuleBus Modem, fiber optic ModuleBus interface of an I/O cluster. 10 Mbit driver.
TC501V150	Cable terminator for AF 100 twisted pairs, 150 ohms
TC505	Connector: AF 100 Trunk Tap to FCI

Table 1-1. I/O Station with S800 I/O Components (Continued)

Device Type Designator	Function
TK801V003	Cable, ModuleBus Extension, 300 mm (11.8")
TK801V006	Cable, ModuleBus Extension, 600 mm (23.6")
TK801V012	Cable, ModuleBus Extension, 1.2 m (47.25")
TK811V015	Cable, Optical ModuleBus Extension, 1.5 m (59"), duplex, plastic
TK811V050	Cable, Optical ModuleBus Extension, 5 m (16'), duplex, plastic
TK811V150	Cable, Optical ModuleBus Extension, 15 m (50'), duplex, plastic
TK812V015	Cable, Optical ModuleBus Extension, 1.5 m simplex, plastic
TK812V050	Cable, Optical ModuleBus Extension, 5 m simplex, plastic
TK812V150	Cable, Optical ModuleBus Extension, 15 m simplex, plastic
TU810	Compact MTU, 3*8 + 2*3 terminals, 50V
TU811	Compact MTU, 2*8 terminals, 250V
TU812	Compact MTU, 25 pin D-sub Connector for field connection, 50V
TU814	Compact MTU, Crimp Snap-in Connector for field connection, 50V
TU830	Extended MTU, 3*16 + 2*4 terminals, 50V
TU831	Extended MTU, 8*2 terminals, 250V
TU835	Extended MTU, 4*2 groups + 2*4 power terminals, 50V, individually fused per channel
TU836	Extended MTU, 2*4 groups + 2*6 power terminals, 250V, individually fused per channel
TU837	Extended MTU, 2*4 groups + 2*6 power return terminals, 250V, fused
TU838	Extended MTU, 2*4 groups + 2*4 power return terminals, 50V, fused

Table 1-1. I/O Station with S800 I/O Components (Continued)

Device Type Designator	Function
TU890	Compact MTU, I.S. applications, 50V
SD811	Power supply, 120/230V a.c. to 24V d.c. @ 2.5A
SD812	Power supply, 120/230V a.c. to 24V d.c. @ 5.0A
RE810	Wall Cabinet, IP65, 800 x 1000 x 300 mm (31.5 x 39.4 x 11.8)

1.2.1 Product Scope

The S800 I/O is a modular I/O system. The modular system allows for easy configuration of the I/O type and size.

An S800 I/O Station can consist of a base cluster and up to 7 additional I/O clusters. The base cluster, consists of a Fieldbus Communication Interface module (FCI) and up to 12 I/O modules. I/O clusters 1 to 7 consist of a ModuleBus Modem and up to 12 I/O modules. I/O clusters 1 to 7 are connected to the FCI though a fiber optic expansion of the ModuleBus. An S800 I/O Station can have up to 24 I/O modules. This means that an I/O Station can have a maximum of 384 digital channels or a maximum of 192 analog channels.

An S800 I/O Station base cluster can also consist of redundant FCIs to provide greater availability of communications between the Advant Controller and the ModuleBus.

Each I/O cluster can be divided in groups using ModuleBus extension cables between the groups. The maximum length of the electrical ModuleBus of an I/O cluster is 2.5 meters (8.2 ft.) including extension cables. The factory made extension cables which plug into the cable adaptors are available in lengths of 0.3, 0.6 and 1.2 m (1, 2 and 4 ft.). The maximum length of the optical ModuleBus expansion is dependent on the number of ModuleBus Modems. The maximum length between any two clusters is 15m (50ft.) with plastic fiber and 200m (667ft) with HCS glass fiber. Factory made optical duplex cables (plastic fiber) are available in lengths of 1.5, 5 and 15 m (5, 16.7 or 50 ft.).

ModuleBus

Each I/O module is installed on a Module Termination Unit (MTU). The first MTU with its I/O module connects to the FCI or a cluster's ModuleBus Modem and then each of the remaining MTUs connect to the previous MTU. With redundant FCIs, the ModuleBus connects to the ModuleBus Interconnection Unit.

An FCI communicates with its I/O modules over the ModuleBus. The ModuleBus can be divided into 8 clusters, one base cluster and up to 7 I/O cluster. The base cluster consists of the FCI and I/O modules. Additional I/O clusters (1 to 7) consist of a ModuleBus Modem and I/O modules. The ModuleBus Modems are connected via optical cables to an optional ModuleBus Optical Port module on the FCI.

Within a cluster the ModuleBus is made up of increments that are integrated into each MTU. The FCI and ModuleBus Modems have a ModuleBus outlet connector to connect to an MTU. An MTU has a bus inlet and a bus outlet connector. By adding, on the DIN rail, an MTU to a FCI or a ModuleBus Modem, the bus is automatically expanded up to a maximum of 12 MTUs. Unique position codes are automatically assigned to each MTU as the bus is expanded. An inserted I/O module is assigned the unique position identity of its MTU. Through the incremental bus design the physical size of an S800 I/O installation is directly proportional to the number of installed MTUs.

The S800 I/O modules can be inserted and removed from MTUs without disturbing system operation. The physical lock, which locks an I/O module to its MTU, allows I/O module removal only when the lock is in its unlock position. The locking mechanism also acts as a logic lock so that an I/O module is only operational when the lock is in the locked position. If the lock is in its unlocked position, output channels are de-energized and I/O modules can be inserted/removed without need to remove system or field power.

The MTUs are totally passive units with all active circuitry allocated to the I/O module. The ModuleBus requires a terminator to be installed after the last MTU of an I/O cluster.

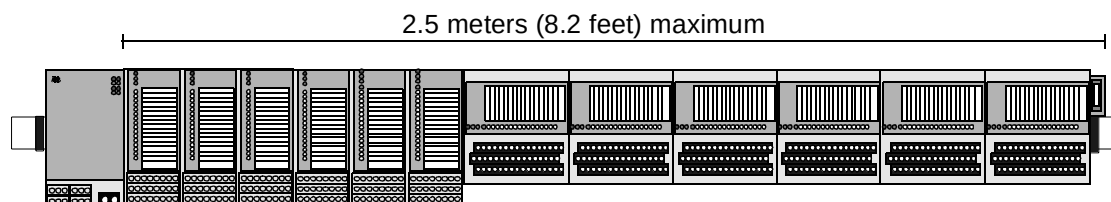


Figure 1-2. Typical I/O Station Base Cluster with S800 I/O

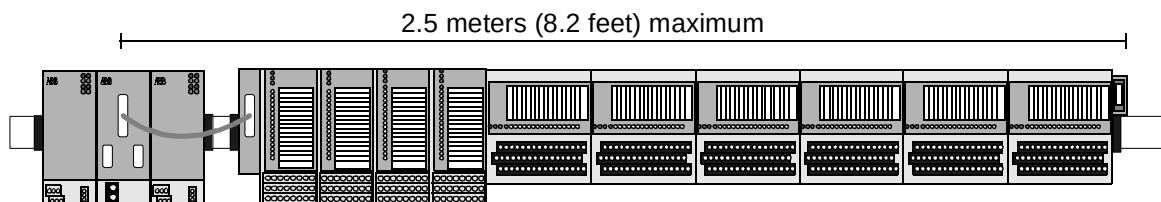


Figure 1-3. Typical I/O Station Base Cluster with Redundant FCIs to S800 I/O

1.2.1.1 CI810 Fieldbus Communication Interface

The CI810 Fieldbus Communication Interface (FCI) module is a configurable communication interface which performs operations such as signal processing, gathering of various supervision information, OSP handling and configuration of re-inserted I/O modules. The FCI connects to the controller by way of the Advant Fieldbus 100 (AF 100) twisted pair segment. The FCI supports redundant media configurations.

Please refer to specifications in *S800 I/O Fieldbus Communication Interface for Advant Fieldbus 100* for more information.

1.2.1.2 CI820 Fieldbus Communication Interface

The CI820 Fieldbus Communication Interface (FCI) module is a configurable communication interface which performs operations such as signal processing, gathering of various supervision information, OSP handling and configuration of re-inserted I/O modules. The FCI connects to the controller by way of the Advant Fieldbus 100 (AF 100) twisted pair segment. The FCI supports redundant fieldbus communication interface.

Please refer to specifications in *S800 I/O Fieldbus Communication Interface for Advant Fieldbus 100 User's Guide* for more information.

1.2.1.3 CI830 Fieldbus Communication Interface

The CI830 Fieldbus Communication Interface (FCI) module is a configurable communication interface which performs operations such as signal processing, gathering of various supervision information, OSP handling and configuration of re-inserted I/O modules. The FCI connects to the controller by way of the PROFIBUS-DP fieldbus.

Please refer to specifications in *S800 I/O Fieldbus Communication Interface for PROFIBUS-DP User's Guide* for more information.

1.2.1.4 TB815 Interconnection Unit

The TB815 Interconnection Unit is used with redundant CI820 FCIs to provide an interface to the ModuleBus (electrical and optical) and service port connections. All signals between the redundant FCIs such as AF 100 signals and control signals are routed through the TB815 and it also provides the termination of the electrical ModuleBus.

Please refer to specifications in *S800 I/O Fieldbus Communication Interface for Advant Fieldbus 100 User's Guide* for more information.

1.2.1.5 TB810/TB811 ModuleBus Optical Port

The TB810/TB811 Optical ModuleBus Port is used with the CI810 or CI830 FCI or the TB815 Interconnection Unit to provide an interface for the Optical ModuleBus expansion. The TB810/TB811 has two connectors for fiber optic connections and a

connection to the communication interface module. TB810/TB811 Optical ModuleBus Port

TB810 is used with TB820 and ABB-Drives equipment with 10 Mbit driver.

TB811 is used with ABB-Drives equipment with 5 Mbit driver.

Figure 1-4 shows the TB810/TB811 installed in the CI810 FCI.

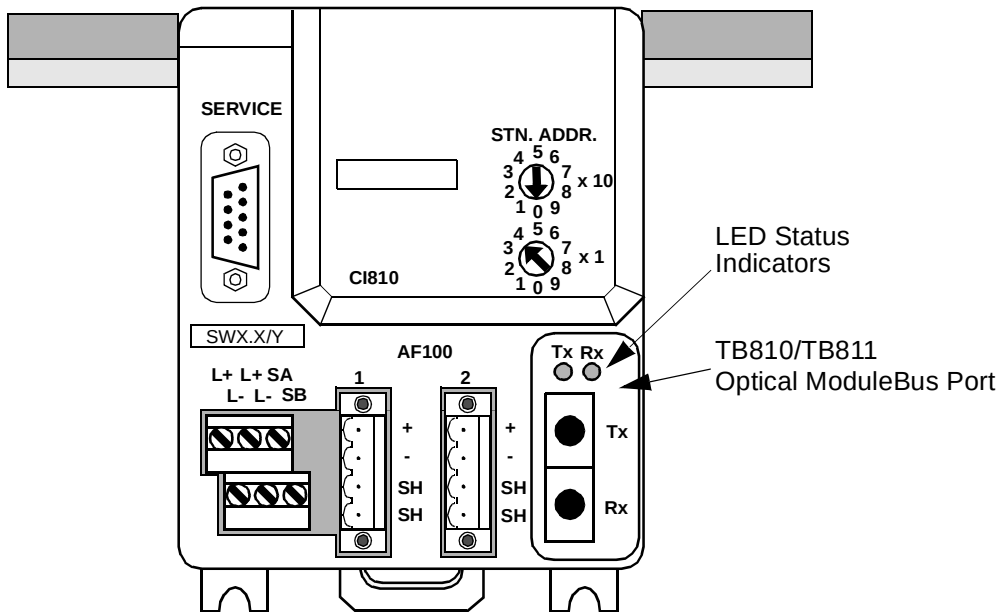


Figure 1-4. TB810/TB811 Optical ModuleBus Port installed in CI810 FCI

1.2.1.6 TB820 ModuleBus Modem

The TB820 ModuleBus Modem is a fiber optic interface to the ModuleBus. The ModuleBus Modem has an electrical and an optical interface which are logically the same bus. A maximum of 12 I/O modules can be connected to the electrical ModuleBus and up to seven clusters can be connected to the fiber optic ModuleBus. The fiber optic interface is intended for local distribution of I/O clusters and where more than 12 I/O modules are required in an I/O Station.

The TB820 ModuleBus Modem has a rotary switch that selects its cluster number, 1 to 7, on the optical ModuleBus. Figure 1-5 shows the layout of TB820.

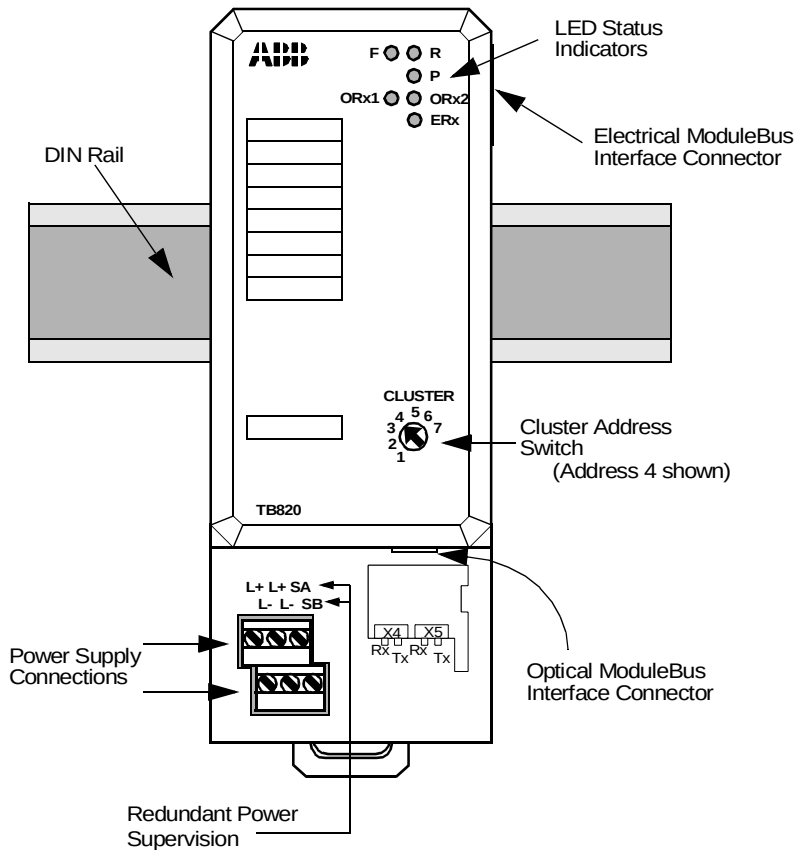


Figure 1-5. TB820 ModuleBus Modem

The ModuleBus Modem communicates with the CI810 FCI via a TB810, or the TB815 Interconnection Unit via a TB810, and to the I/O modules. The FCI handles the I/O-modules operations such as read and write data, read status and configuration of modules and channels.

The TB820 ModuleBus Modem provides 24V d.c. short circuit proof (from the source) and an isolated, short circuit proof 5 V dc power to the cluster's I/O modules by way of the electrical ModuleBus connection. One power source (single or redundant 24V d.c.) can be connected to the power terminals (L+ & L-). Redundant power supply can be supervised via inputs SA and SB.

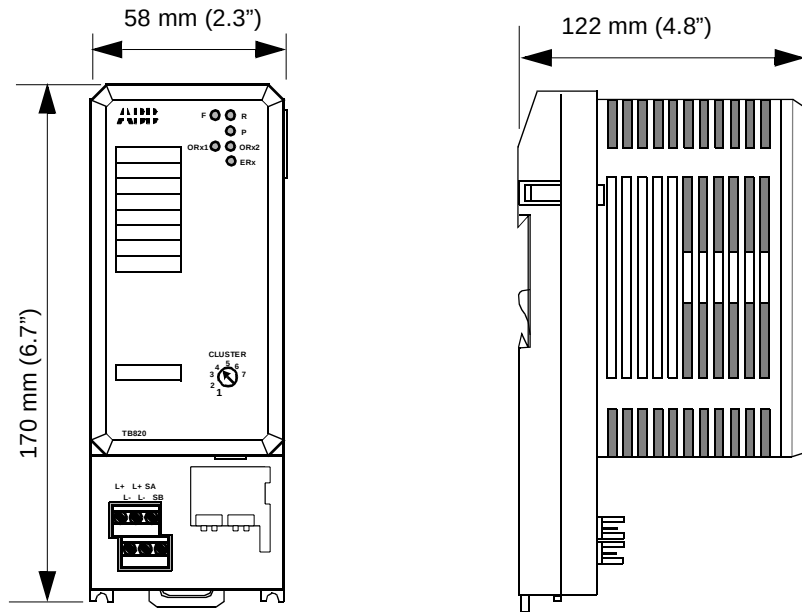


Figure 1-6. TB820 ModuleBus Modem Dimensions

Please refer to specifications in Appendix A, References for more information.

1.2.1.7 Module Termination Units

The Module Termination Units (MTU) are passive base units used to house the I/O modules. They contain the process wiring terminals and a section of the ModuleBus.

Please refer to specifications in *S800 I/O Modules and Termination Units* and *S800 I/O Modules and Termination Units with Intrinsic Safety Interface User's Guide* for more information.

1.2.1.8 I/O Modules

The I/O modules have open ventilated plastic enclosures. On the front of each I/O module there are three LEDs (FAULT, RUN and WARNING) indicating the module status and digital I/O modules have a status LED for each channel, some even two. One additional LED (OSP) is included on analog output and digital output modules.

I/O modules may be replaced in a fully operational I/O station. Mechanical keying on modules and MTUs protect I/O modules from being inserted in positions where they could be damaged by excessive voltage or current. An electronic type designation ID in each module keeps the I/O module from being taken into operation by the FCI, if a module's ID does not match the configured module type definition in the data base.

Please refer to specifications in *S800 I/O Modules and Termination Units* and *S800 I/O Modules and Termination Units with Intrinsic Safety Interface User's Guide* for more information.

1.2.1.9 Power Supply

The SD811 and SD812 are switch-mode power supply units which convert the mains voltage to 24 volts d.c. These power supplies can be utilized for non-redundant and redundant applications and do not require additional load-sharing control equipment or diode voting units.

Please refer to specifications in Section A.1, SD811/SD812 Power Supply Module, 24V d.c. for more information.

The S800 I/O station can be powered by a single or redundant supply voltage of 24V d.c., see Figure 1-7, Figure 1-8. Two power supplies with 120/230V inputs and 24V d.c. outputs are available to supply the I/O station and its field circuits. The SD811 Power Supply provides 2.5A at 24V d.c. and the SD812 Power Supply provides 5A at 24V d.c. See Power Supply Connections for details.

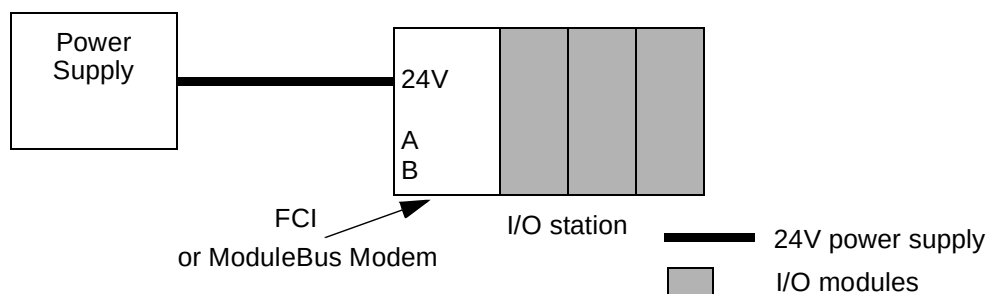


Figure 1-7. Installation Using Single Power Supply Unit

The FCI and ModuleBus Modem are able to supervise the redundant voltage supply. The supervision function is individually configurable for power supervision of each I/O station.

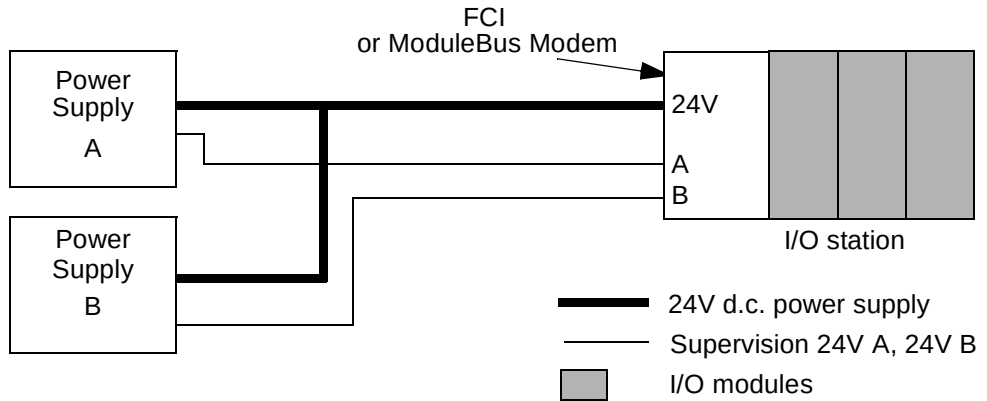


Figure 1-8. Installation Using Redundant Power Supply Units

1.2.1.10 Example of Enclosure Configurations

In Figure 1-9 a layout example are shown for an I/O station in an RE810 cabinet which could house the I/O station with power supplies for the I/O system as well as for the field powering, and space for marshalling terminals.

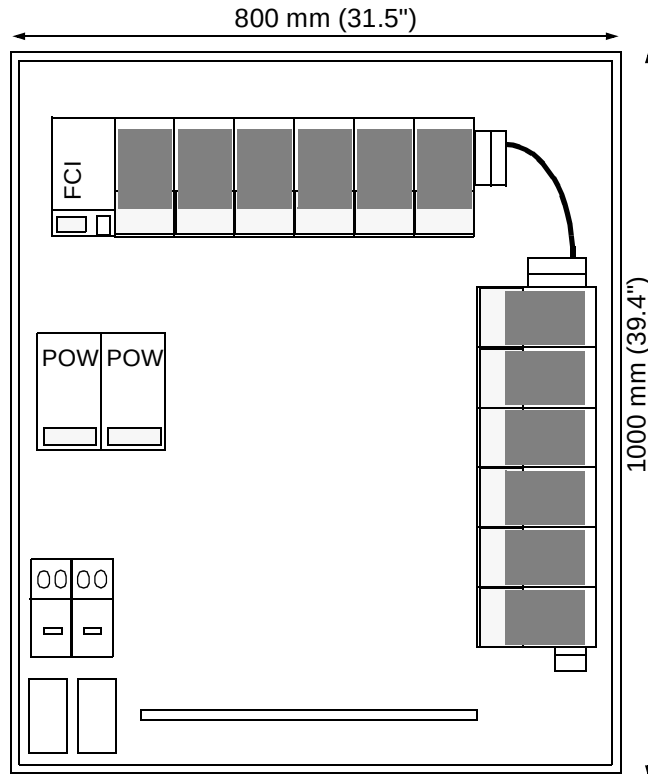


Figure 1-9. RE810 Cabinet with 12 I/O Modules and Redundant Station Power Supplies

1.2.1.11 Support for External Intrinsic Safety System

Beside S800 I/O modules with Intrinsic Safety Interfaces, Intrinsic Safety Systems can be connected to the S800 I/O.

Intrinsic Safety System from ELCON Instruments (manufacturer outside ABB) is supported via S800 I/O module and a special MTU.

Supported Intrinsic Safety System is the HiD Series 2000.

The S800 I/O modules are connected via MTU TU812, a standard cable and a specific adapter board, one for each I/O module types.

For further information refer to *Elcon Instruments manuals* and *Intrinsic Safety Support S800 I/O with Series 2000*.

The following I/O modules are supported:

AI810, AO810, DI810 and DO810.

See Figure 1-10 for an example of a connection between S800 I/O and Intrinsic Safety System.

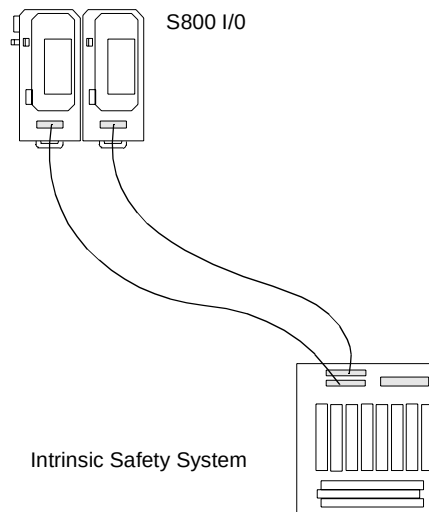


Figure 1-10. Example of Connection between S800 I/O and Intrinsic Safety System from ELCON

1.2.1.12 Support for HART

ELCON Instruments provides a HART protocol connection to I/O modules integrated with the Intrinsic Safety System, see Figure 1-11.

For further information refer to *Elcon Instruments manuals* and *Intrinsic Safety Support S800 I/O with Series 2000*.

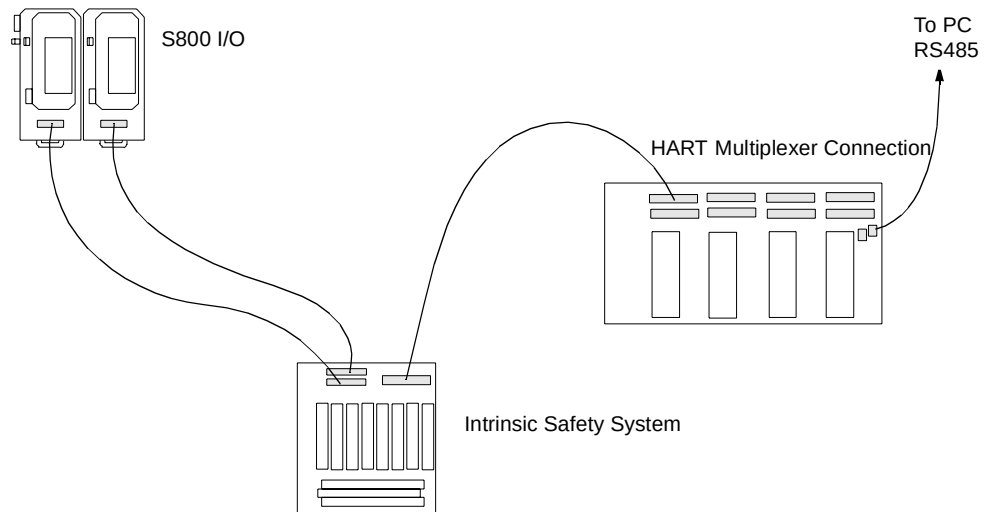


Figure 1-11. Example of Connection between S800 I/O and Intrinsic Safety System from ELCON and HART Multiplexer Interface from HART

1.3 Related Documentation

Table 1-2 lists all documentation related to the S800 I/O system.

Table 1-2. Related documents

Category	Title	Description
S800 I/O User's Guide	S800 I/O Modules and Termination Units	Describes the standard I/O modules and termination units in the S800 I/O system
S800 I/O User's Guide	S800 I/O Modules and Termination Units with Intrinsic Safety Interface	Describes I/O modules and termination units with I.S. interface in the S800 I/O system
S800 I/O User's Guide	S800 I/O Fieldbus Communication Interface for Advant Fieldbus 100	Describes the AF100 FCI in the S800 I/O system
S800 I/O User's Guide	S800 I/O Fieldbus Communication Interface for PROFIBUS-DP	Describes the PROFIBUS-DP FCI in the S800 I/O system
S800 I/O User's Guide	S800 I/O PROFIBUS-DP Fieldbus Communication Interface, Reference Manual	Describes the memory mapping on PROFIBUS for the S800 I/O system
Installation	Interference-free Electronics	Describes the rule for the installation of equipment to ensure the correct operation of equipment in environments where disturbance are present
Installation	Environmental Data for ABB Products	This manual contains a summary of the ABB product environmental factors
Installation	Advant Fieldbus 100 User's Guide	Describes the equipment and contains information required to install and commission AF100
Installation	Intrinsic Safety Support S800 I/O with Series 2000.	Describes how S800 I/O connects to Series 2000 from Elcon Instruments.
Installation	ABB Installation Rules	Describes the equipment and contains information required to install and commission.

1.4 Terminology

The following is a list of terms associated with S800 that you should be familiar with.

Term	Description
AF 100	Advant Fieldbus 100 is the communications bus between the I/O stations and the Advant Controllers. (FCI to CI52x)
FCI	The Fieldbus Communication Interface (FCI) device contains the interface to the fieldbus (e.g. AF 100), ModuleBus interface and power regulators. The FCI module can manage 24 I/O devices (up to 12 directly and to the others in 1 to 7 I/O clusters).
Base cluster	Advant Fieldbus 100 is the communications bus between the I/O stations and the Advant Controllers. (FCI to CI52x)
I/O cluster	An extension of the I/O Station's ModuleBus connected to the FCI by fiber optic connections. Up to 12 I/O devices per cluster.
I/O device	A complete I/O device consists of one MTU and one I/O module.
I/O module	Is the active, electronic and signal conditioning part of an I/O device.
I/O station	An I/O station consists of one or two FCI(s), 1-7 I/O clusters and up to 24 I/O devices.
ModuleBus	Is an incremental, electrical or optical, bus for interconnection of I/O devices.
(ModuleBus) Extension cable	Is used when extending the electrical ModuleBus (within the max. 2 meters).
MTU	The Module Termination Unit is a passive base unit containing process terminals and a part of the ModuleBus.

Term	Description
OSP	Outputs Set as Predetermined. A user configurable action on an output module when communications is lost to the FCI or Controller.
PROFIBUS-DP	PROFIBUS-DP is a fieldbus standard.
RTD	Resistance Temperature Detector.
SOE	Sequence of events. Time stamping of status changes for digital inputs.
TC	Thermocouples
I.S.	Intrinsic Safety is a protection technique to prevent explosion in hazardous areas of a process plant

Chapter 2 Installation

This chapter contains guidelines for planning the installation of the S800 I/O equipment.

This chapter does not give the complete list of measures to be taken with respect to environment and other conditions on site. The equipment should be adapted to the actual application by thorough system definition and design.

Since each system is designed to meet a specific requirement, there is no standard configuration that describes every system. Therefore, certain areas of the following instructions are meant only as a guide for planning a specific installation. However, some of the information covers specific requirements for proper system and equipment operation, and is not subject to modification.

All information given in this chapter relates to standard equipment.

For installation of Advant Fieldbus 100 and Advant Fieldbus 100 modems, see the *Advant Fieldbus 100 User's Guide*.

For installation of PROFIBUS see relevant documentation.

2.1 Site Planning

2.1.1 Site Selection and Preparation

When planning an S800 I/O installation, please consider the following:

- Surrounding environment and atmosphere.
- The temperature in the room where the equipment is to be located. This should include an estimation of the resulting temperature rise with respect to the power dissipation from the planned equipment.
- Proximity of the equipment to the process.
- Size of the cabinets to accommodate all the required equipment.
- Minimum distances from a cabinet to walls and ceiling to obtain satisfactory results from different aspects.

- Ease of access for moving equipment in and out of area.
- Free space in front of cabinets. Also consider the need of space to fully open a cabinet door either left hand or right hand hinged.
- Spare area for future expansion of the system.
- Grounding by an effective plane of copper bars.
- Cable routing with respect to installation rules.
- Availability of power and other utilities.

The following sections examine some of these factors in detail and provide recommendations and requirements as necessary.

2.1.2 Environmental Considerations

General

S800 I/O equipment can be installed in a designated control room, or located in the process area when housed in a suitable enclosure. The S800 I/O is designed for a demanding industrial environment.

Temperature

I/O Module Factors

The maximum ambient air temperature around S800 modules is 55°C (131°F) for I/O modules mounted on Extended MTUs on vertical or horizontal orientated DIN-rails. I/O modules mounted in Compact MTUs on a vertical DIN-rail allows operation at 40°C (104°F) and horizontal DIN-rail allows operation at 55°C (131°F).

The ambient temperature de rating which applies for vertical DIN-rail and Compact MTUs is due to the reduced air flow through an I/O module due to the orientation.

The different hardware modules in the S800 I/O have different outputs of heat. Accurate calculation of the heat produced by the system requires knowledge of the modules and the work cycle. Power supplies with regulated outputs are highly recommended to minimize heat in cabinets. Use of such devices will reduce the power loss of resistive loads and current outputs, for example, digital inputs and

analog outputs. Please refer to Section 3.1.8, Power and Cooling for more information.

Cabinets Factors

The temperature within cabinets and in the surrounding environment and atmosphere must be considered, especially when using sealed cabinets (IP65/IP54) or tropicalized cabinets (IP41) with considerable equipment and outside ambient temperatures at levels approaching 40°C (104°F). The frequency of faults is estimated to double for each 20° C (36°F) increase in temperature. Thus, it is important to maintain as low ambient temperature outside the cabinets (typical operating range 10 - 40°C (50 - 104°F)) as possible where the equipment is installed. Design considerations are given in Section 3.1.4.2, Heat Dissipation Permitted in Cabinets.

Vibration

The cabinets are to be located on a stable floor, wall, deck or supporting structure, free from vibrations.

If the system equipment is installed in a control room adjacent to large machinery such as shakers or large presses, where frequent major vibrations occur, shock absorbers or an isolation pad may be required to protect the system equipment. Shock absorbers normally protect the equipment from sustained low level vibrations (vibrations that are perceptible, but not excessive). If vibrations or shock is a major problem, more extreme measures must be considered to alleviate the problem, such as fasten the MTUs with extra screws.

2.1.3 Electromagnetic Compatibility and CE Marking

Grounding, cable selection and cable routing must be considered for electromagnetic interference-free operation. Planning considerations are discussed in the following sections. Instructions for implementing these plans are provided in Section 2.2, Installation Procedures.

The S800 I/O meets requirements specified in EMC Directive 89/336/EEC. You should request CE marking and compliance when ordering the equipment.

For more information about environmental immunity, including EMC qualities with or without CE marking, refer to the *Environmental Data for ABB Products* data sheet.

2.1.4 Layout of I/O Stations

2.1.4.1 I/O Station with S800 I/O

The S800 I/O is mounted on a DIN-rail. The DIN-rail is mounted in a cabinet or on an enclosure wall to a metal sheet with fastening screws every 100 mm to ensure a good chassis ground connection in the cabinet or an open rack. The FCI, ModuleBus Modem and MTUs are mounted to the DIN-rail. The FCI, ModuleBus Modem and MTUs have a snap locking device that attaches it to the mounting rail. It is possible to mount the FCI, ModuleBus Modem and MTUs both vertically and horizontally. The FCI, ModuleBus Modem or MTU is placed on the top edge of the DIN-rail and the bottom latch mechanism can be snapped into place.

To mount the unit, place it on the top edge of the DIN-rail, release the rail latch with a flat blade screw driver and snap the bottom mechanism into place. When the unit is in place on the DIN-rail and in vertical position, take away the screw driver and the rail latch will fix the unit in position on the DIN-rail. Release the unit from the DIN-rail in a similar way.

A flat blade screw driver can be used to release the latch to allow easier movement along the DIN-rail or removal of the unit (Figure 2-1).

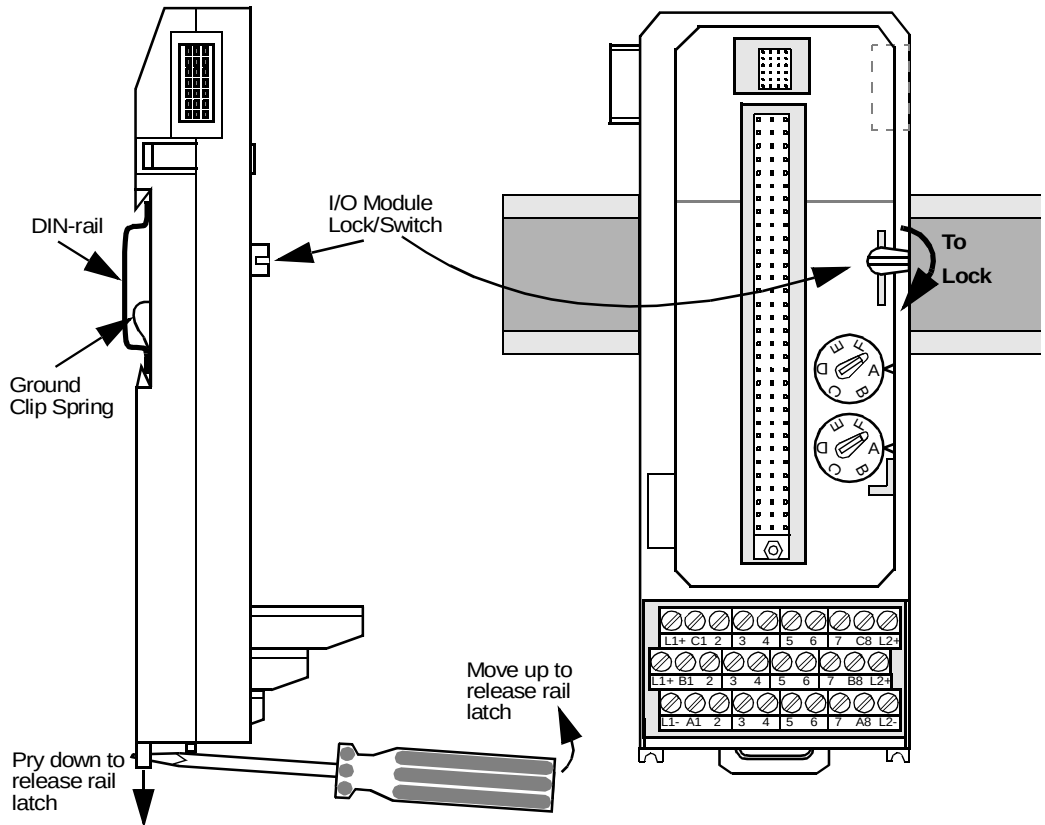


Figure 2-1. MTU Latching System

Snapping the FCI, ModuleBus Modem or MTU to the DIN-rail makes contact by a grounding spring with the chassis.

Connection of the MTU ModuleBus connector to the FCI, ModuleBus Modem or next MTU is made by sliding the MTU along the mounting rail and then locking it in place (Figure 2-2).

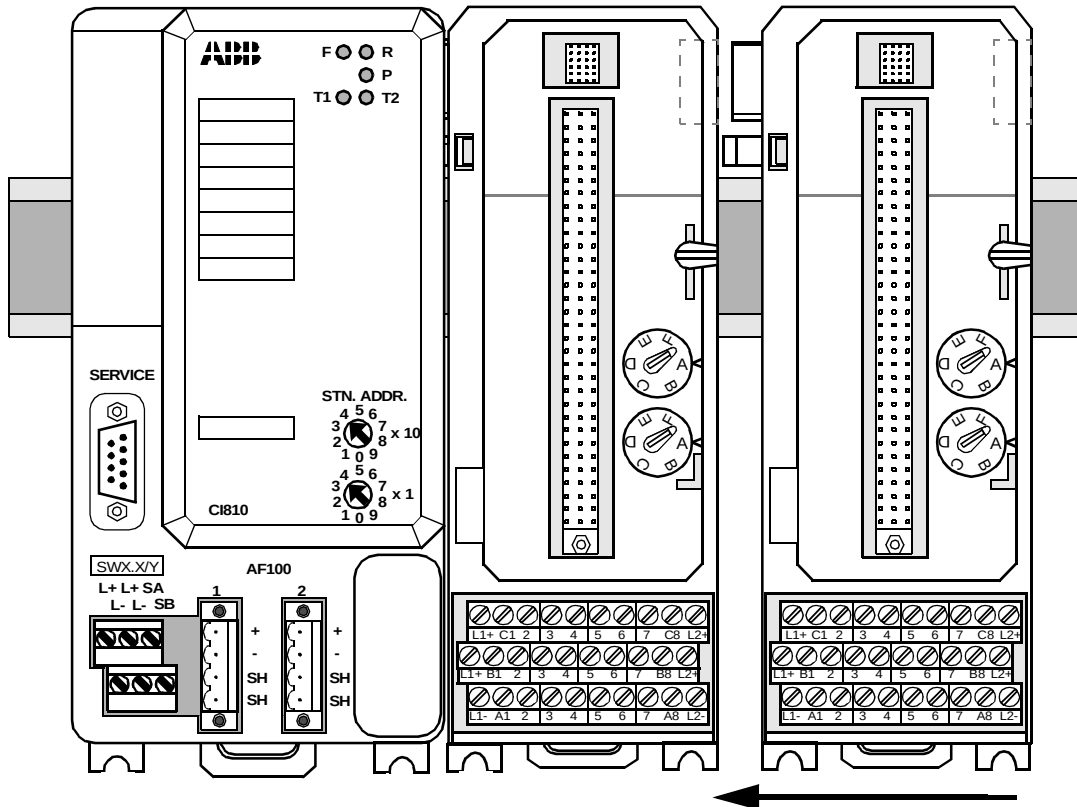


Figure 2-2. I/O Station Installation Diagram

The MTU can be disconnected from the FCI, ModuleBus Modem or another MTU by using a screw driver and pressing it between the two items.

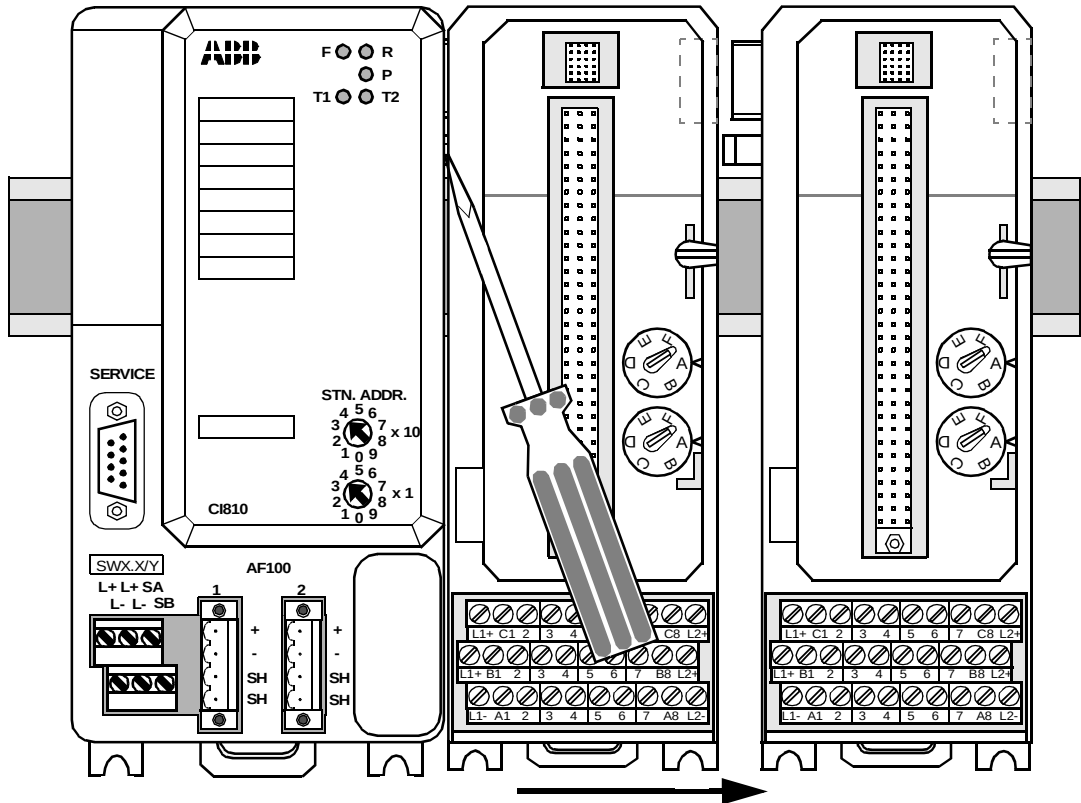


Figure 2-3. ModuleBus Release

Redundant FCI Installation

Installation of an I/O Station with redundant FCIs requires two CI820 FCIs and a TB815 Interconnection Unit (Figure 2-4). They are connected to the I/O modules of the base cluster by an electrical ModuleBus extension cable. From the TB815 ModuleBus connector, a TK801V0xx cable is connected to the first MTU via a TB806 Cable Adapter-in module.

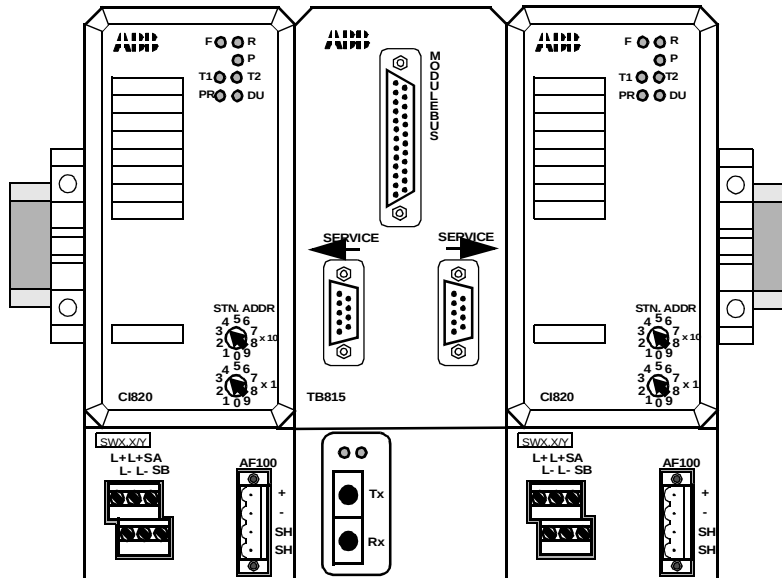


Figure 2-4. Redundant CI820 FCIs and TB815 Interconnection Unit Layout

The redundant FCIs can either be mounted on a separate DIN rail or the same one as the I/O modules. Room must be allowed to the left and right of the FCIs for disconnection from the TB815 for removal (Figure 2-5).

The total length of the ModuleBus extension, from the TB815, and ModuleBus segments of the I/O modules must not exceed 2.5 meters (8.2 feet).

Optical ModuleBus Extension can be connected to the TB815 via the TB810 ModuleBus Optical Port unit for connection of 1 to 7 additional I/O clusters.

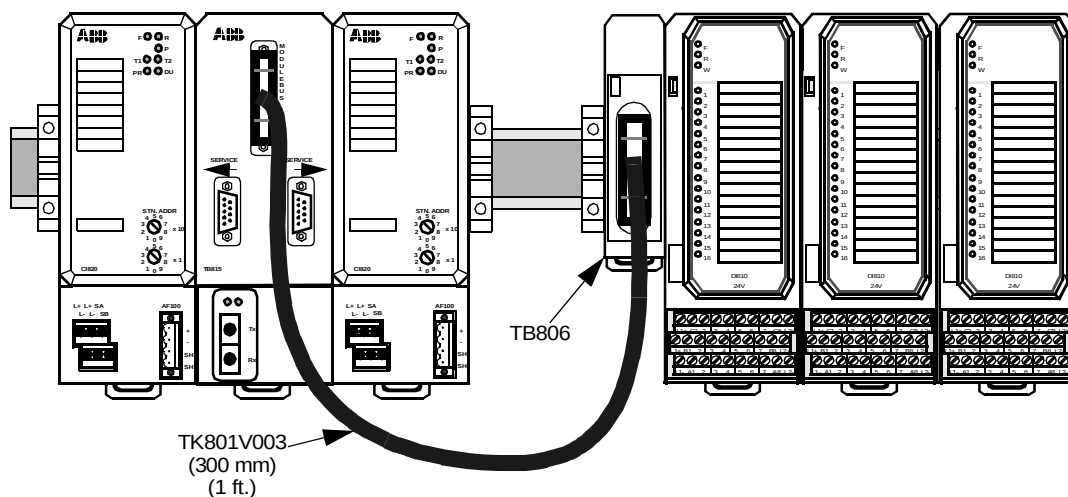


Figure 2-5. Connection of Redundant FCIs to I/O Modules

ModuleBus Extension (Electrical)

When the next MTU is located away from the previous MTU, or from the TB815 Interconnection Unit, then a TK801V0xx ModuleBus Extension cable must be used. The previous MTU will require a TB805 Cable Adapter-out to be plugged into the ModuleBus-out connector. The TK801V0xx cable is then connected to the TB805 adapter. The next MTU will have a TB806 Cable Adapter-in plugged into the ModuleBus-in connector and then connected to the other end of the ModuleBus Extension cable (see Figure 2-6).

The TB805/TB806 ModuleBus Cable Adapter-Out/In adapters mount on the DIN-rail. Each has a latch that locks it to the rail. There is also a grounding spring that connects it to the DIN-rail. The latch can be released with a screw driver and the adaptor moved toward or away (for removal) from the MTU.

The ModuleBus Extension cable comes in three standard lengths:

- TK801V003 - 300 mm (1 ft.)
- TK801V006 - 600 mm (2 ft.)
- TK801V012 - 1.2 meters (4 ft.).

ModuleBus length must not exceed 2.5 meters (8.2 feet) from FCI, TB815 Interconnection Unit, or ModuleBus Modem to the last MTU including extension cables.

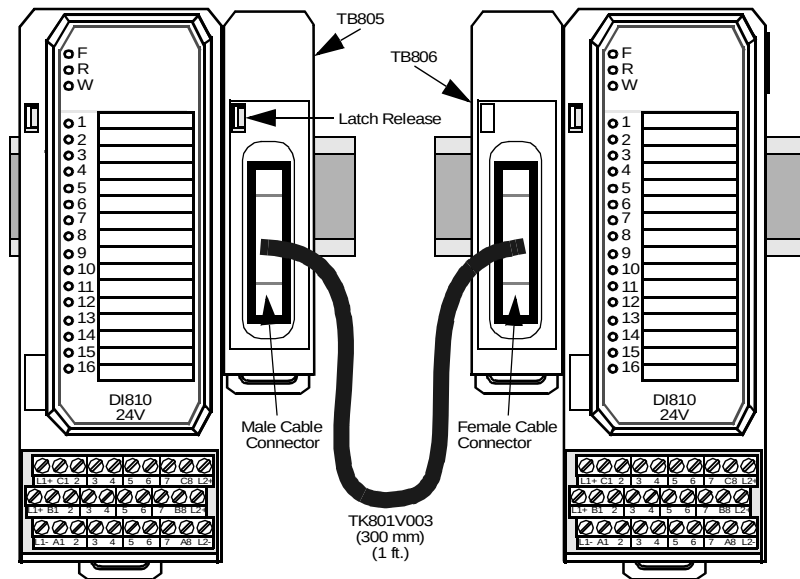


Figure 2-6. ModuleBus Extension Cable Connections

Optical ModuleBus Expansion

The FCI provides fiber optic expansion of the ModuleBus for up to 7 additional I/O clusters or to drive equipment. The TB810/TB811 ModuleBus Optical Port must be inserted in to the CI810 or CI830 FCI and TR815 Interconnect unit FCI to provide optical ModuleBus expansion. See Figure 2-7 for location of the TB810/TB811on

the CI810/CI830 FCI and Figure 2-8 for location in the TB815 Interconnection Unit.

TB810 has 10 Mbit drivers and is used with the TB820 (S800 I/O) and ABB drives equipment. TB811 has 5Mbit drivers and is used with ABB variable drives ACS 600 equipment. The TB811 can only use up to 10 meters (33 ft) plastic optic fiber. A Modulebus must have the same type of drivers on each node.

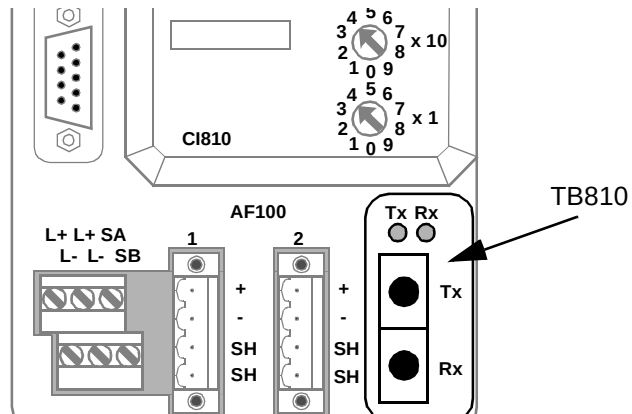


Figure 2-7. Location of TB810/TB811 ModuleBus Optical Port in CI810 FCI

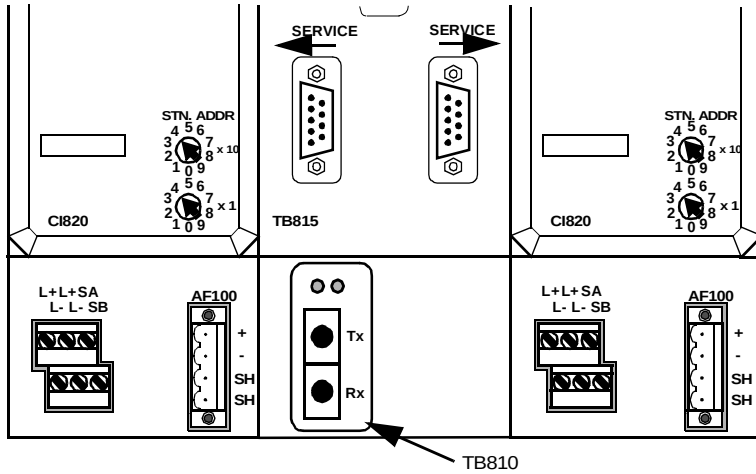


Figure 2-8. Location of TB810/TB811 ModuleBus Optical Port on the TB815

Each I/O cluster can have a maximum of 12 S800 I/O modules. The maximum number of S800 I/O modules or other units connected to one FCI is 24. The optical ring connection or duplex connection allows for a maximum distribution of 15m (49 ft.) (plastic fiber) or 200m (667 ft.) (HCS fiber) between each I/O cluster, see example in Figure 2-9.

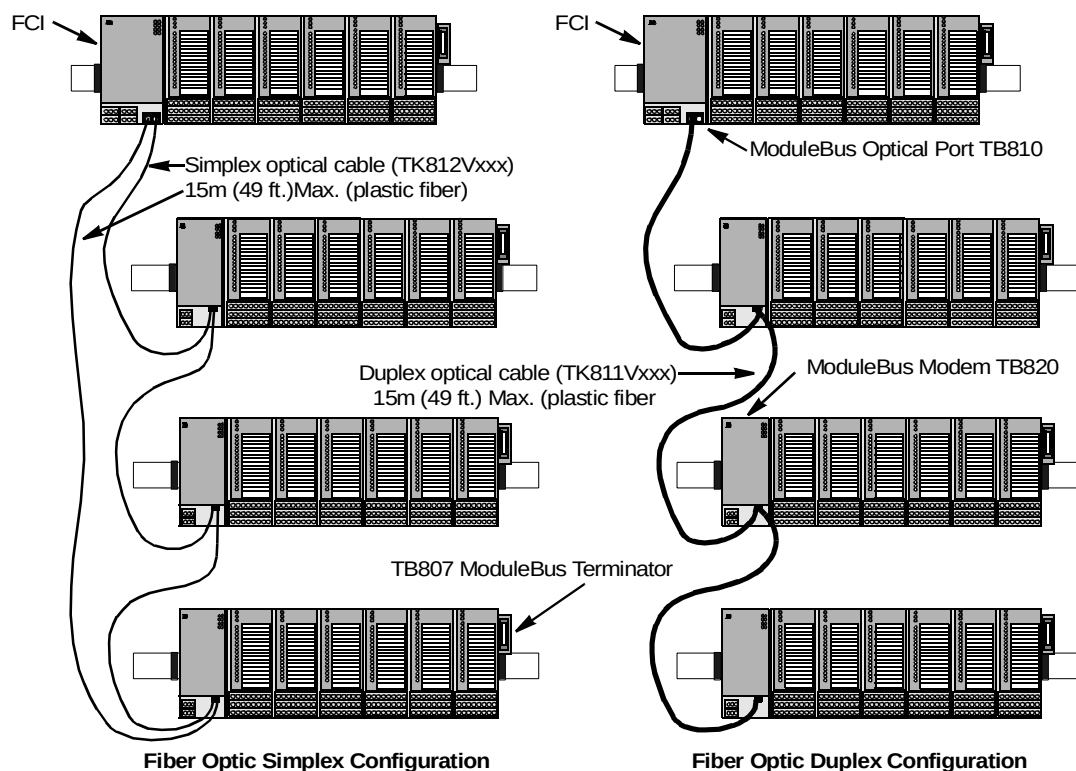


Figure 2-9. Optical ModuleBus Expansion, Simplex and Duplex Configurations

The TB820 can be used in both a simplex optical configuration as well as in a duplex optical configuration. In a simplex optical configuration, the optical ModuleBus nodes are connected in a ring. In a duplex optical configuration, the optical ModuleBus nodes are connected in a row.

The optical ModuleBus Extension fiber optic (plastic fiber) cable comes in three standard lengths:

- TK811V015 (duplex), TK812V015 (simplex) - 1.5 meters (5 ft.)
- TK811V050 (duplex), TK812V050 (simplex) - 5 meters (16 ft.)
- TK811V150 (duplex), TK812V150 (simplex) - 15 meters (49 ft.)

As with the FCI (base cluster), the electrical ModuleBus length must not exceed 2.5 meters from the ModuleBus Modem to the last MTU of each cluster. Each cluster requires a TB807 ModuleBus Terminator plugged into the last MTU.

I/O Module Installation

Connection of the I/O module to the MTU is made by setting the I/O Module Keys #1 and #2 to the correct setting, place the I/O Module Lock/Switch to the unlock position and then push the I/O module straight onto the MTU. The I/O module is locked and electrically connected to the MTU by the I/O Module Lock/Switch.

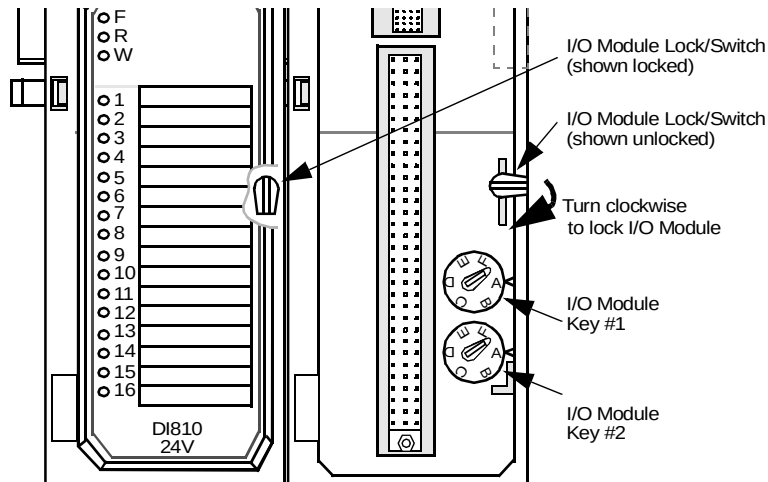


Figure 2-10. MTU Mechanical Keys for I/O Module and Module Lock



Do **not** turn the I/O Module Lock/Switch counter-clockwise from the unlocked position. This will cause it to break and will make the MTU and the I/O module inoperative.

After all the MTUs are connected, the TB807 ModuleBus Terminator connects to the ModuleBus connector of the last MTU of the I/O Station. The TB807 has a snap latch (Figure 2-11) that holds it in place. To release the terminator, the latch has to be squeezed to allow removal.

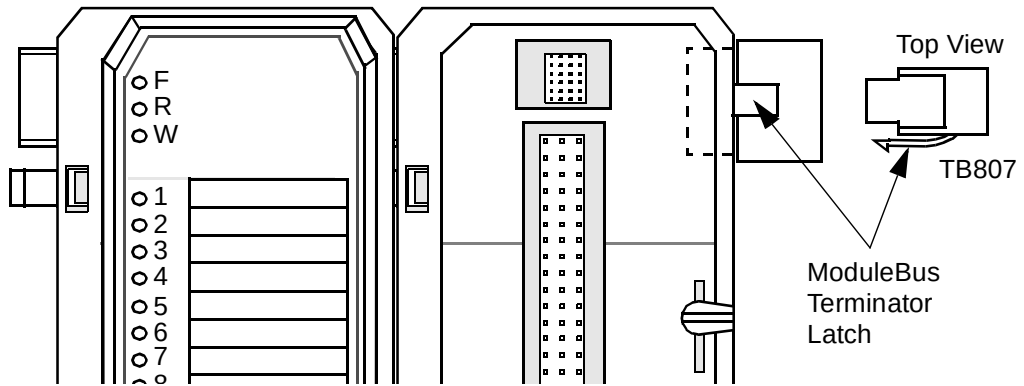


Figure 2-11. TB807 ModuleBus Terminator Installation

The I/O Station configuration can be as shown in Figure 2-12 and/or as presented in *S800 Standard Modules and Termination Units* and Section 1.2.1.10, Example of Enclosure Configurations.

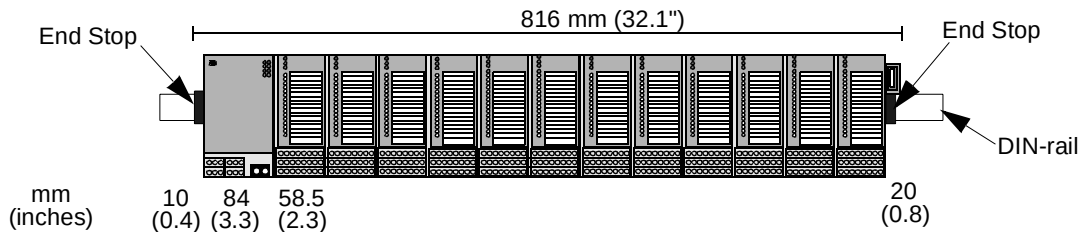


Figure 2-12. I/O Station Layout with FCI and S800 I/O Modules

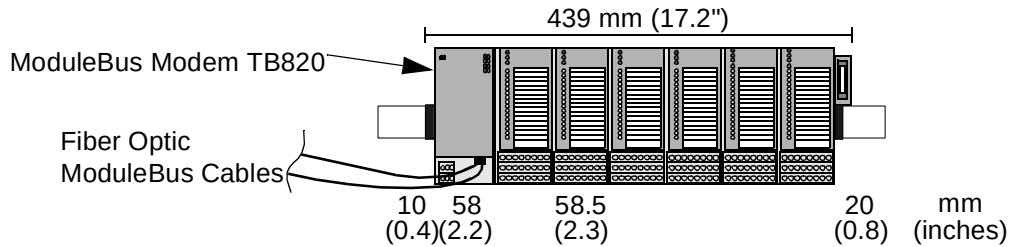


Figure 2-13. I/O Station Layout with ModuleBus Modem and S800 I/O Modules



In all installations, two end stops must be mounted on the DIN-rail, one at each end of the station, to prevent the modules from moving along the rail, see Figure 2-12

The installation rules should be followed as much as possible. The flexibility of the system allows both horizontal and vertical mounting of the rail and mixing of MTU types as shown in Figure 2-14.

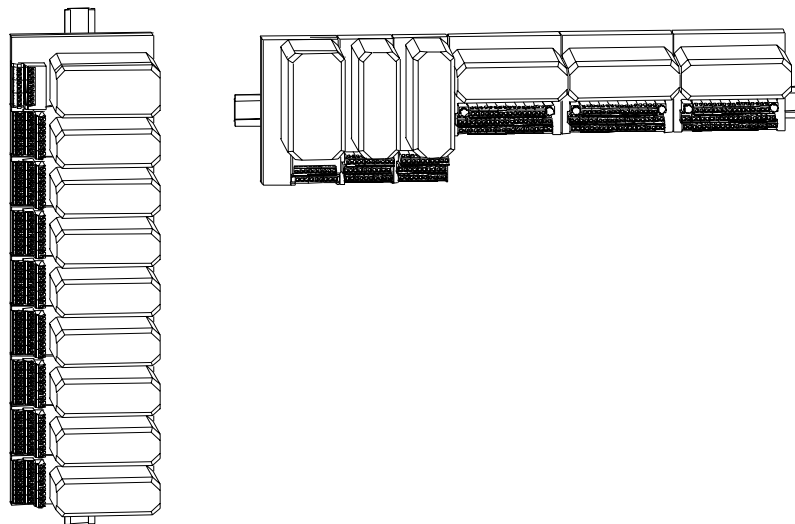


Figure 2-14. Compact and Extended MTU and Horizontal and Vertical Mounting

2.1.5 Grounding

General

The interference suppression for external signals, are normally directly grounded to chassis and/or plant ground. The plant ground potential must be stable and well defined, even in the event of a low ground fault caused by high voltage equipment or a lightning strike.

Each I/O module's grounding spring connects to the metallic DIN-rail which serves as the module electronics ground conductor between the inter-connected devices. This is to ensure a good ground connection both for the internal logic and for the EMI immunity and RF emission of the modules. The DIN mounting rail must have a good bond to the PE of the cabinet.

If S800 I/O-modules are configured as two or more groups interconnected with extension cables, special care should be taken to ensure that the DIN-rails of all groups have a good connection to ground. If the DIN-rails are mounted on a common metal sheet, no extra means need be taken except to make sure that each rail has a reliable low ohmic path to the metal plate. Protective earth connection can be made at a single point on the common metal plate.

The ground wire which joins the grounding systems should be $\geq 35 \text{ mm}^2$ (2 AWG) copper (Cu), Figure 2-15.

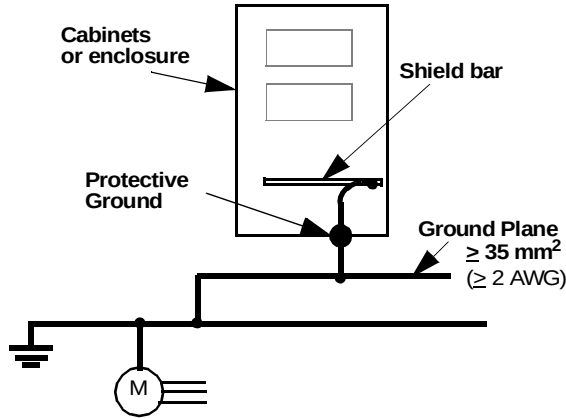


Figure 2-15. Grounding of Electronic Equipment

Protective Earth (PE)

Cabinets supplied with 120/220V a.c. always must be connected to protective earth (PE) grounding. The equipment PE-conductor should be of 35 mm^2 (2 AWG) cross section if copper lead.

Grounding of Signals and Voltage Supply

For minimum interference and maximum accuracy, it is normally most effective to ground the signals from transmitters or transducers directly at a grounding point within the cabinet. It is also advantageous to ground supply voltages for transducers, sensing voltage for contacts, load supply voltage and so on at the same location. All modules have galvanic isolation from the chassis; this means that group-wise isolated modules can be grounded in different equipment as long as all channels have a common ground reference at the same location.

In the event that the above recommendations (because of measurement techniques or safety regulations) cannot be complied with, be sure to use these methods:

- Signal isolation for analog input signals
- Digital inputs and outputs are divided into groups at the MTUs and I/O modules, with supply voltage distribution and grounding common for each single groups.

Local grounding of a signal at the transducer location may be a requirement for individual voltage supply to each transducer. This normally hinders the use of MTUs for voltage distribution. A ground bar with the terminal block and fuse equipment required by the application can be used in such cases.

If the transmitter/transducer has galvanic isolation of the supply, its signal zero can be grounded where most suitable for measurement accuracy.

2.1.6 Signal Cable Considerations

When planning for the cable routing in the plant and when selecting suitable cables to be used, the following should be considered:

- Routing of communication cables with regard to a.c. power wiring.
- Mixing of signals and signal types within cables.
- Need of shielded or un-shielded cables.

Cable entry into cabinets is generally from the bottom. Alternative cable entrances can be accommodated if required. Refer to *ABB Installation Rules* for details.

2.1.6.1 Recommendations for Signal and Process Cable

For use in a typical industrial environment according to the basic protection:

1. Unshielded lines are adequate for binary signals and high level (0...20mA, $\pm 10V$...) analog signals.
2. Shielded cables should be used for low level (RTDs, TC...) analog signals and pulse transducer signals.
3. Minimize the loop area formed between the cable and earth (environment ground), for example by laying the cable on metallic trays that are earthed at several points. Closed cable conduits provide an additional attenuation of up to 30 dB.
4. Use separate cables for analog, binary and heavy current lines. Lay the cables separately sorted according to type. The signal cables and heavy current cables should be in separate conduits or at least 30cm apart from each other.
5. The return-conductor should be in the same cable as the signal.
6. The field cables must be wired according to the recommendations of Figure 2-16.
7. Advant Fieldbus cable installed per the *Advant Fieldbus 100 User's Guide*.
8. PROFIBUS-DP cable installed according to PROFIBUS.

For modules with special LED indications see respectively modules in *S800 I/O Modules and Termination Units* manual.

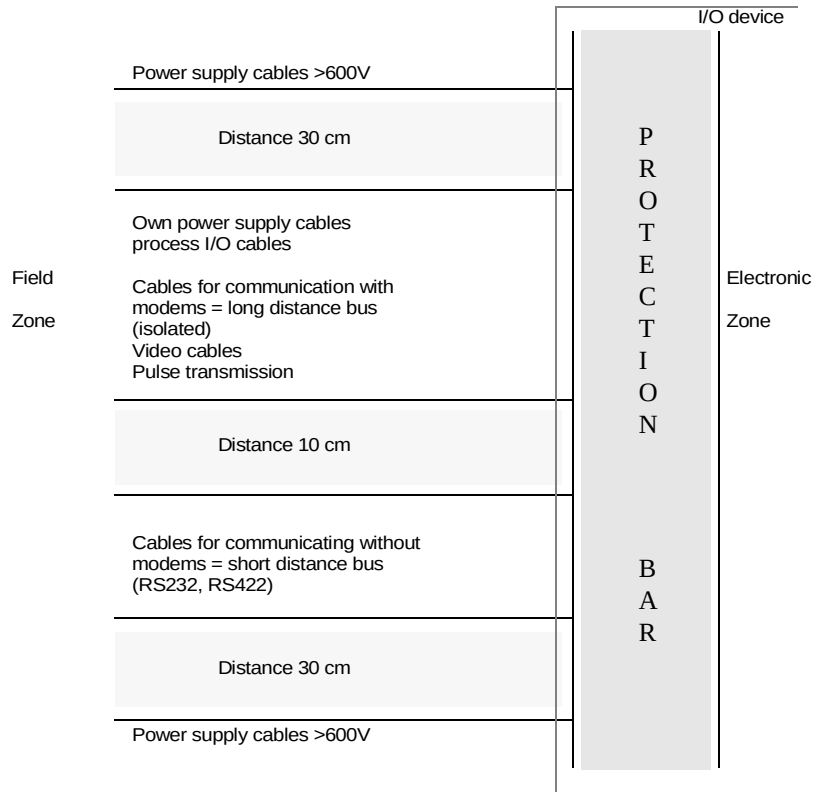


Figure 2-16. Recommended Field Cable Wiring Distances

2.1.7 Power Requirements

General

Power supplied to ABB system's power supply units and for external supply to I/O can normally be obtained from the plant a.c. or d.c. supply sources.

A.C. Supply

A power source can be rated as Installation Category II or III with respect to level of disturbances, voltage variations and so on, according to IEC standards. Standard voltage range is 110 - 240V a.c. Installation Category II denotes a higher quality than III mains. The S800 I/O power supplies SD811 and SD812 are rated for Overvoltage Category II for Installation Category III mains.

D.C. Supply

Table 2-1. Requirements for d.c. Supply Sources

Device	Voltage Range
FCI/ModuleBus Modem	19.2 - 30
SD811/SD812	185 - 250

When using a d.c. source, only floating battery or rectified d.c. systems can be used for powering of ABB systems without galvanic isolation between the system and the current source. With this type of supply, the power supply source is grounded in the ABB equipment.

Externally grounded power supply requires an isolating d.c./d.c. converter for the system.

2.1.8 Hazardous Applications

I/O modules with Intrinsic Interfaces or standard process I/O modules and MTUs together with isolators or barriers should be used when interfacing towards equipment installed in hazardous locations.

2.1.9 High Voltage Switch-gear Applications

The I/O modules are not designed for direct connection to high voltage switch-gear. Interposing relays are used for digital input and output signals as a connecting link. For analog signals, special transmitters/converters are used.

2.1.10 Lightning Strike Protection

Industrial installations and power plants are normally provided with well-integrated grounding networks installed together with the power distribution system.

In installations with such grounding systems, it is not necessary to install lightning strike protection unless overhead wiring or suspended cables are used outdoors.

Large plants (water supply installations, refineries and so on) can however have an inadequate grounding system and signal cables can be routed above ground. In such cases lightning strike protection must be used.

Cables outside the grounding system (even for short distances such as 10 m) always require lightning strike protection.

2.1.11 Mounting Dimensions

When placing a control cabinet, specified minimum distances to walls and ceiling must be kept to ensure satisfactory performance.

Overhead Clearances

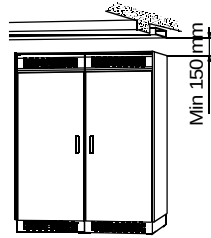


Figure 2-17. Minimum Distance to Cabinets

To ensure adequate ventilation, there should be a free space, 150 mm (6") high, between the top of the cabinet and the ceiling, the underside of any beam, duct or similar object over the cabinet. When cables enter the cabinet from above, the space available should be at least 1000 mm (40") high to provide working space, see Figure 2-17.

Rear and Side Clearance

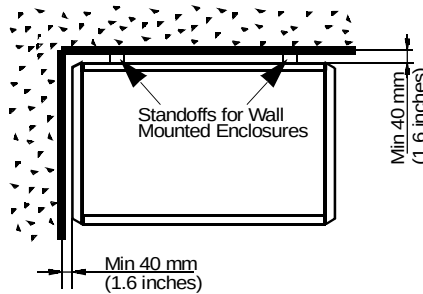


Figure 2-18. Minimum Distance from Rear and Side of Cabinet to a Wall

The distance between the rear and the sides of the cabinet and an adjacent wall should be no less than 40 mm (1.6 inches), see Figure 2-18. This will ensure good ventilation.

The free space in front of the cabinet should be the width of the door plus aisle width.

Wall mounted enclosures should use standoffs equal to the clearance requirements.

Clearances within an Enclosure

Clearances within an enclosure are described in Figure 2-19.

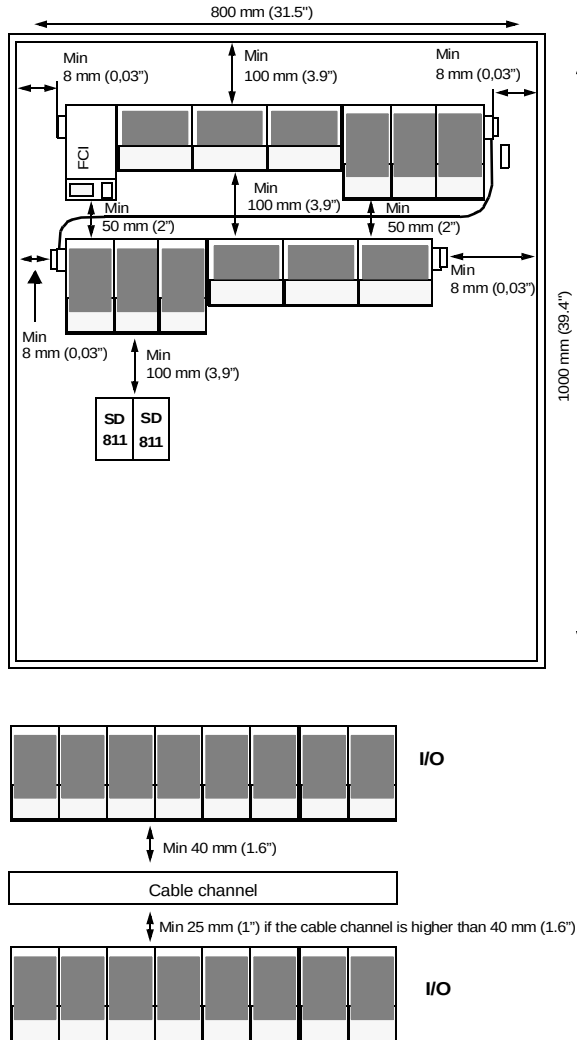


Figure 2-19. Enclosure with 12 Modules and Redundant Station Power Supplies

2.2 Installation Procedures

After some general information in the following section, you will find individual setup descriptions for different parts of the system. The information is given under the following headings if relevant.

- Assembly
- Electric Installation (including Power Supply)
- Functional Measures
- Preparation for Start Up.

Standard installation drawings, terminal diagram forms, and connection documents for site preparation and installation of electrical equipment may apply also.

Equipment Required

The following is a minimum requirement:

- Ordinary hand tools
- Universal instrument, for example, digital multimeter.
- Necessary parts of the documentation listed in Section 1.3, Related Documentation.
- Specific documentation enclosed with the equipment, drawings and so on.

2.2.1 Safety Regulations

The following instructions are to be followed when installing and operating an S800 I/O system to minimize the risks of injury to personnel and damage to the equipment. Local statutory regulations, to the degree that they are more strict than the following are to take precedence.

2.2.1.1 Personnel Safety

The following are to be observed:

- Voltage supply of a cabinet shall never be switched on during installation work.



Work with care when supply voltage is applied to the system. Voltages within the cabinet can cause serious injury or death

- All who work on the installation must know the location of the main power supply switch to the equipment and how it is operated.
- When the subsections of the process are checked and a test run has been performed, interlocking links are to be checked by a responsible engineer. All assembly personnel must be informed about test runs to be performed.
- Process technicians are to be present when testing and operating the process device.

2.2.1.2 Equipment Safety



Observe the following safety rules:

- Avoid direct contact with the bus connector of the I/O modules.
- Always switch off the voltage before extracting a module which can not to be exchanged with power applied, for example, processor units, extension cable adaptors and extension cables, see Chapter 5, Maintenance. Wait a sufficient time for the capacitors to discharge before removing a power sensitive module.

2.2.2 Grounding in enclosures

This section describes where and how grounding is to be done in a cabinet or small enclosures. You should be aware of the common *ABB Installation Rules* manual which establishes the principals of grounding, knowing when an equipment, a circuit or a cable shield should be grounded. It also gives alternative solutions adapted to specific plant requirements.

General

When cabinets are connected together, it forms a stable ground plane for all equipment installed. The signal processing electronics in the modules as well as all interference suppression for external signals is normally directly grounded to chassis and plant ground.

Protective Earth

The main power source distribution normally includes a protective ground wire. This shall be connected to the protected earth (PE) terminal block on a primary power switch unit. Use cable lug connectors when connecting on the ground screw.

Ground Line

The cabinet is to be grounded with a copper lead (≥ 35 mm, 2 AWG) to the plant ground line. Cabinets in a row shall be individually connected to the plant ground plane as required.

Grounding of Process Cable Shields

Process cable shields are, as applicable, attached directly to the cabinet ground.

Grounding of Communication Cable Shields

The shields of communication cables are to be connected directly to the modem or FCI module in an I/O station. This pertains to conventional shielded multi-lead cable. Please refer to the *Advant Fieldbus 100 User's Guide* and relevant PROFIBUS documentation for more information.

Grounding of Process Signals

There are three applications of signal grounding directly to chassis. (High frequency grounding by capacitors is always provided and not discussed in this context).

- Refer to *S800 I/O Modules and Termination Units User's Guide* for the grounding requirements of each I/O module.
- Signals can be commonly grounded by earthing the reference 0V of centralized power supply for loads and sensing. Such a power supply system must be grounded to the same earth line as the system.
- Individual grounding of a signal in the I/O cabinet is possible (if applicable with respect to I/O module type). The requirement for such an application, is when the signal is not grounded elsewhere, for example, not locally grounded at load/sensor or not grounded via a power supply grounding.



Do not ground the same circuit at different points in the plant.

Grounding of Additional Equipment

Additional power supply units of different types used by loads or sensor, and modems and so on, and are located in the controller or I/O cabinet, shall be treated in the following way with respect to grounding:

- The apparatus chassis (PE terminal) shall be connected to the installation protective earth terminal or directly to cabinet chassis if the apparatus chassis and bounding are accepted for protective bounding.
- No circuitry of an equipment shall be completely electrically floating but referenced to a suitable potential.

2.2.3 Cable Routing in Enclosures

There are some restrictions in mixing cables within a cabinet due to the risk of interference. To describe the simple rules applicable at site installation, cables are divided in categories. See Table 2-2 and the following rules for custom cabinet installations:

- Within a category cables can be arbitrary mixed.
- The distance between cables belonging to different categories shall be kept ≥ 50 mm (2").
- "Cabinet internal" junctions have their own defined spaces for routing. Distance to other cables should always be ≥ 50 mm (2").

Table 2-2. Cable Categories in a Cabinet

Cable / Application	Category
Power supply (a.c. / d.c.)	1
Process I/O, shielded and unshielded cables	2
Communication	2
ModuleBus extension to S800 I/O	3

2.2.4 Power Connection

General

Cabinets erected side by side including a controller and I/O configuration are regarded as a unit, and are connected to the a.c. (d.c.) power in one single connection point, the centralized Power Switch unit. The switch unit is normally located in the controller cabinet bay.

The power can be distributed to the I/O cabinets as required by the installed equipment (Figure 2-20).

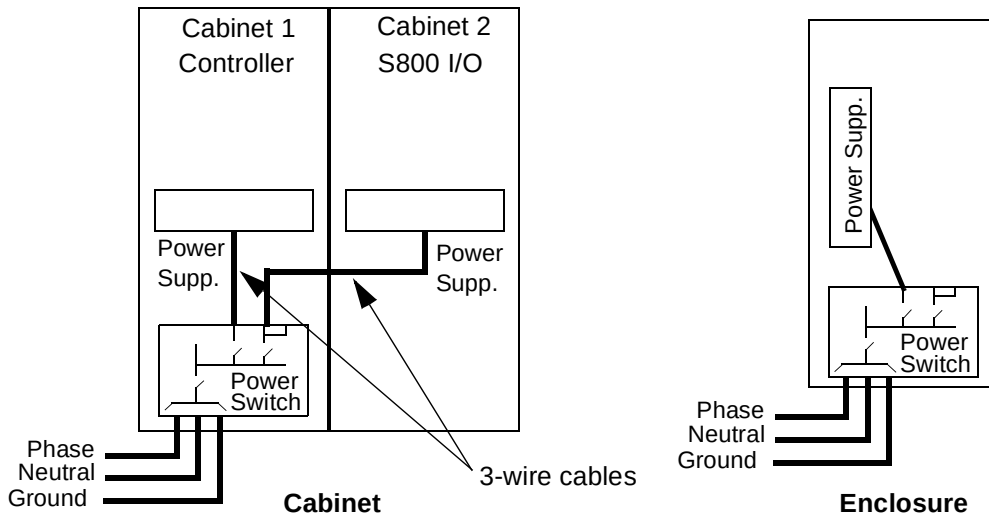


Figure 2-20. Power Supply Connection and Distribution

2.2.5 I/O Station with S800 I/O

Assembly

Information regarding location of equipment may be found in the documentation delivered with the equipment. Some general I/O Station information is presented below.

- Install a DIN-rail sized to allow installation of the FCI, ModuleBus Modem, MTUs, terminator and power supplies. Some extra DIN-rail should be allowed for expansion or the moving of the FCI, ModuleBus Modem or MTUs during maintenance.
- Install the FCI, ModuleBus Modem on the left end of the DIN-rail leaving some room to the left to allow removable from the first MTU. If vertical mounting is used, leave room to the top of the FCI for removal.
- Install the first MTU to the right (below) of the FCI or ModuleBus Modem and all other MTUs to the right (below) of the preceding MTU.
- The last MTU (12 max.) connected to the FCI or ModuleBus Modem will have the TB807 Terminator installed in the ModuleBus connector.
- Set each MTU mechanical keys to the correct setting for the I/O module that will be located there.
- The power supply modules may be located on the same DIN-rail as the FCI or ModuleBus Modem and the I/O modules, but should be always located on a horizontal DIN-rail because of its weight.
- Install an end stop before the first module and after the last one on the DIN-rail.
- Then proceed with the electrical connections as necessary.

Electric Installation

Advant Fieldbus 100 Fieldbus Connection

The AF100 Fieldbus is connected to the terminals of a CI810 or a CI820.

The incoming fieldbus twisted pair cable is connected to a plug connector with four terminals, two for the signal wires and two for the shield. The incoming and outgoing fieldbus signal + conductors are terminated in the + terminal.

The - conductors are both terminated in the - terminal. The cable shield drain wires

are terminated in the two SH terminals and they must be bridged to ensure a continuous shield connection in case the fieldbus plug is removed from the FCI. Keep the drain wires as short as possible ($\leq 50\text{mm}$). If the unit is at the end of the bus, a terminator (TK501Vxxx) must be connected. Please refer to the *Advant Fieldbus 100 User's Guide* for complete details.

PROFIBUS-DP Fieldbus Connection

The PROFIBUS-DP fieldbus is connected to the terminals of a CI830. The incoming fieldbus cable is connected to a 9 pin D-way connector. If the unit is at the end of the bus, a connector with termination must be used. Please refer to relevant PROFIBUS documentation.

I/O Clusters (1-7)

The TB820 ModuleBus Modem of an I/O cluster is connected to the CI810/CI830 FCI or TB815 Interconnection Unit by Optical Expansion cables. The optical ModuleBus can be a simplex, duplex or mixed design.

Optical cable length between each cluster must not exceed 15 meters with plastic fiber cable and 200 meters with glass fiber cable.

Refer to Section 3.1.1.3, TB820 ModuleBus Modem for optical ModuleBus configurations.

Distributed MTUs

The MTUs are joined to the I/O modules with plug-in connectors. An MTU can be extended to another MTU by using a ModuleBus extension cable. The following instructions apply:

Cable length and ModuleBus length must not exceed 2.5 meters.

Cable routing in cabinets, see Section 2.2.3, Cable Routing in Enclosures.

Process Signals

Process signals are connected to the MTUs according to site installation drawings.

The following instructions also should apply:

- Cable routing in cabinets, see Section 2.2.3, Cable Routing in Enclosures.
- Grounding of cable shields and Process signals, see Section 2.2.2, Grounding in enclosures.

A carefully done electrical installation is the basis for future interference-free operation.

Functional Measures

Address Jumping

All S800 I/O modules are automatically set to the correct addresses by the ModuleBus interconnection scheme.

The FCI module station address should be set to the assigned PROFIBUS-DP or Advant Fieldbus 100 station number set by the station address switches. Refer to *S800 I/O Fieldbus Communication Interface for PROFIBUS-DP* or *S800 I/O Fieldbus Communication Interface for Advant Fieldbus 100* manual as to location of address switches.

The ModuleBus Modem cluster address should be set to the assigned cluster number by the cluster address switch. Refer to Section 1.2.1.6, TB820 ModuleBus Modem.

Preparation for Start-up

Check of the External Wiring

The level of workmanship must be judged case by case, and the results will determine the need for a check of all connections before the system is powered up. It is possible to check, with a buzzer, that the external wiring to the process equipment is correct and that all conductors are intact. The check of the field wiring should be done before the I/O modules are installed. It is also possible, without activating the control equipment, to check that transmitters, transducers and actuators (including all process wiring) to see if they function correctly. This makes it necessary to connect voltage to these units and develop suitable checking methods.

An alternative method, is to make an integrated check of the process equipment, wiring and the corresponding controller functions. This should be done on a point by point basis. Preferably the controller should be loaded with the application data base. The data base is then used as one check-point. Status / values can be read and control signals to process devices can be simulated by an operator station.



Be aware of the risk of “accidents”. Short-circuit and over-voltage can damage the equipment, for example, a process I/O board or field element

2.2.6 Checklists

The following checklists, Table 2-3 to Table 2-10, are a summary of important information that should be checked for the installation.

2.2.6.1 Grounding Philosophy, Ground Plane System

Table 2-3. Grounding Philosophy, Grounding System

Item	Concerning	Check
Grounding philosophy	Ground system	Grounding to PE network only. Only one ground system. No exceptions.
Ground plane system	Design	The ground line system of the installation must be carefully installed and must incorporate the switchgear.

2.2.6.2 Process Cabling, Shielding, Grounding, Max. Length

Table 2-4. Process Cabling, Shielding, Grounding, Max. Length

Item	Concerning	Check
Cables	Prescribed type	Communication cables Pulse transducer cables Shielded for low level AI (RTD, Pt, thermocouple, and so on). Signal wire and return wire in same cable
Shielding: Single shield	Grounding: AI, AO, DI, DO,	Should be made directly as it comes into the cabinet
	Grounding: Communications pulse transducers	For AF 100 See the <i>Advant Fieldbus 100 User's Guide</i> . For PROFIBUS see relevant documentation.
Cable without shield	Grounding	All signal circuits grounded at the same end
A.C. digital inputs 110V and 220V	Max. cable length	Approximately 200 m (656 ft.)

2.2.6.3 Power Supply

Table 2-5. Supply

Item	Concerning	Check
A.C. Power Mains	Connection in cabinet	Phase Return Protective ground (if distributed) Note: There must be no breaks in the protective ground conductor to the PE terminal.
	Fuse	Incorporated in conductors
	Connection of network	No unsuppressed load on same finale circuit from distribution box
	Use of interference-sensitive power supply units	Special isolation transformer for electronics supply must be used
	Internal distribution	Incoming power supply (110, 230V) must be separated from other cables by 50 mm (2") or more
D.C. (floating battery)	Grounding, supply	Negative pole to neutral ground terminal of cabinet directly at entry to cabinet. If grounding of the battery is not permitted then an isolating d.c./d.c. converter is required
D.C. (grounded battery)	Connection	Via isolated d.c./d.c. converter unless the main d.c. power supply is grounded at the I/O terminals
I/O Station Supply	Max. power output	< 90% of regulator capacity

2.2.6.4 Lightning Protection

Table 2-6. Lightning Protection

Item	Concerning	Check
Lightning protection		Protections are compulsory for all circuits in: Overhead lines Cables that leave the general ground line network

2.2.6.5 MTU, I/O Module

Table 2-7. MTU, I/O Module

Item	Concerning	Check
Mounting rail (for MTUs)	Ground connection to cabinet chassis via mounting screws	If problems, check $R < 100 \text{ m}\Omega$, measured with equipment switched off and cables disconnected
MTU	Ground connection	DIN rail mounting screws (100 mm pitch) fully tightened
Connections	Quality	Only correctly made, screwed or clamped connections are approved

2.2.6.6 Cabinet, Internal Cables

Table 2-8. Cabinets, Internal Cables

Item	Concerning	Check
Row of cabinets	Electrical connection (grounding)	Through short 35 mm ² (2 AWG) copper conductors joining the PE terminals in each cabinet.
Cabinet parts (plates)	All parts electrically connected to each other and to the PE bar	$R < 100 \text{ m}\Omega$
Grounding in cabinet	Design	Only one single grounding system for ABB Advant equipment. NO EXCEPTIONS
Temperature in cabinet	Max. permitted temperature for continued operation.	Max. permitted temperature for continued operation in cabinet is +5 to +55°C (41 to 131°F). Measured just below the I/O module. Modules on compact MTUs on a vertical DIN rail allow +5 to +40°C (41 to 104°F) ambient temperature.
Radio emission	Emission	S800 equipment does not require radio proof enclosures.
Shielded cable	Design	Communication, pulse transducers and analog circuits for Low Level (RTD Pt, thermocouples) must be shielded up to the S800 I/O modules
Internal cables	Routing	See Section 2.2.3, Cable Routing in Enclosures. Check that there is no tension in the wiring.

2.2.6.7 Environmental Data

Please refer to *Environmental Data for ABB Products*.

Table 2-9. Immunity Requirements

Environmental Phenomenon	Standard	Severity Level	Test Class	Test Signal	Application
Lightning	IEC 1000-4-5	4kV CMV, 2kV NMV 2kV CMV, 1kV NMV	4 3	1,2/50 - 8/20 us	Power supply PI/O, Com.
Damped Oscillation	IEC 1000-4-12	1kV CMV, 0.5kV NMV	1	0,1; 1 MHz	Power supply, PI/O. Com.
Fast transient	IEC 1000-4-4	4 kV 2 kV	4		Power supply. PI/O, Com.
Continuous signal	IEC 1000-4-6)	10V	3		PI/O, Com. Power supply
Voltage interruption	IEC 255-11	20 ms		10-3000 ms	Power supply
ESD	IEC 1000-4-2	6 kV 8 kV	3	Contact discharge Air discharge	
Electromagnetic field	IEC 1000-4-3	10V/m	3		
Emission	EN 55022		A		

2.2.6.8 Airborne Contaminants

Operation, Storage and Transportation

ISA 71.04-1985 class G2 and ITF SSG 4251 G2

Copper corrosion maximum 1000 Ångström, 28 days (1 month)

2.2.6.9 Miscellaneous

Table 2-10. Miscellaneous

Item	Concerning	Action
Relays and contacts in cabinets	Suppression	Cabling to non-suppressed inductive loads in ABB cabinets must be kept more than 100 mm (4") away from internal cables
Thermocouples	Position of AI835 "CJC" RTD Cold Junction Compensation)	CJC RTD should be placed where the TCs' compensation cable is terminated.
Analog inputs / outputs	Type	For externally grounded transmitters / receivers inputs/outputs must be differential or isolated

2.2.6.10 External Cables

When selecting cables that are to be used in the plant environment, you should know that there are some restrictions and rules to follow:

- Routing of communication cables.
- Mixing of signals and signal types within cables.
- Need of shielded cables.

Refer to *ABB Installation Rules* for details.

2.2.7 Final Procedure Before Start-up

Remove all debris from the work performed and clean off all grease and dirt. Check that no tools or assembly material are left in the cabinets. Vacuum clean the cabinets.

2.3 Start-up and Shut-down Procedures

2.3.1 Start-up Procedures

This section includes power up for the very first definition/configuration of the system resources. A visible result of the start-up procedures, are that all red LED on module fronts are turned off and all green LED are turned on.

2.3.1.1 Safety Regulations

The instructions given in Section 2.2.1, Safety Regulations are applicable in all situations when working with S800 I/O and associated equipment. Please read the instructions carefully.



Work with care when supply voltage is applied in the system. The voltage in the cabinet can cause serious injury or death.

2.3.1.2 Controller and I/O

When the set-up activities are finished and after using Section 2.2.6, Checklists, the equipment will be ready for start-up, but first read the following security guidelines before proceeding.

Security Guidelines

During the power up of S800 I/O there is always a risk of spurious output signals to the process due to a faulty hardware module.

Critical process devices should always be identified and isolated in some way if the process is energized. Examples of different methods are:

- Disconnected output power supply.
- Disconnect the process cables from outputs.
- Remove output S800 I/O modules.

Succeeding operations after power up, including necessary tests, must be performed carefully.

2.3.2 Shut-down Procedures

Before power is switched on, and start-up of the equipment, it is important to know how to shut-down in different situations. This is described below.

2.3.2.1 Safety Regulations

The instructions given in Section 2.2.1, Safety Regulations are applicable in all situations when working with an Advant Controller and associated equipment. Please read the instructions carefully.



Work with care when supply voltage is applied in the system. The voltage in the cabinet can cause serious injury or death.

2.3.2.2 I/O Station

Emergency Shut Down

An emergency stop should always be available. It shall be controlled by local regulations. This is a responsibility of the plant design and construction. The controller system does not supply this special function.

Check the Location of the Emergency Stop and use it in an Emergency Situation.

From the electrical and functional point of view, an emergency stop will have the same consequences to the controller and associated equipment as a safety shut down.

Safety Shut Down

The Advant Controller and its S800 I/O may be mounted in a row of joined cabinets and are connected as a single unit to the mains power source. The I/O Station with S800 I/O may also be located remotely in the process area and have its own power source. Safety shut down, by disconnecting the controller or remote enclosure from the mains, can be carried out in two ways:

- As prescribed in the site planning Section 2.1.7, Power Requirements, there should be a common safety switch installed within 3 m (10 feet) of the cabinets.

Check the Location of the Safety Switch and use it when working with the Equipment.

The safety switch should be arranged to shut down the power of not only the electronics system but also transmitters, transducers and other process devices. In other words, a total power shut down for the plant section controlled.



Since the safety switch is a plant component this document can not stipulate and describe the design exactly. Please check the plant documentation in this respect carefully. Instructions, as to the extent of the power shut down, should preferably be attached to the safety switch.

Regardless of the way, the results and consequences of a shut down will be:

- Zero output to the process devices (S800 I/O).
- De-energized output relays (S800 I/O). Not for normally closed contacts.
- The system is ready for a restart. Restart can be performed when the reason for the shut down is cleared away.

Manual Stop

Beyond the most drastic way of shut down, by disconnecting power, there is an other way to “stop” the S800 I/O:

- Stop program execution in the controller
- Disconnect the I/O station from the fieldbus.

The results of the manual stop method:

- Output modules goes to the OSP state.
- The system is ready for a restart. Restart can be performed by starting the execution in the controller or connecting the fieldbus.

After necessary measures, a restart can take place.

2.4 Product Verification

As the test requirements vary considerably between different installations, the system engineer is responsible for determining the functional requirements which apply.

Equipment Required

The following equipment is a minimum requirement:

- Necessary parts of the documentation listed in Section 1.3 Related Documentation.
- Specific documentation enclosed with the equipment.

In more complex installations which include closed loop control some additional test equipment can be necessary/practical at tuning:

- Access to an operator station for loop tuning.

2.4.1 General

A general description of how to set the controller in operation and start the execution of application program is presented in the Advant Controller manuals. Once the system is started and ready for operation the I/O can be checked.

General information for some functional tests, which can be made to verify the S800 I/O are presented in the following sections.

2.4.1.1 Check of Process Input/Output Systems

With the application program running in the controller, the inputs and outputs can be checked. This should be done by using a signal by signal procedure. The data base is then used as a final check-point.

It may be necessary to simulate digital and analog input signals which are normally generated by the process. Suitable methods are:

- Digital inputs: Activate the input by connecting a voltage which corresponds to the nominal value of the input. The "1" and "0" status is simulated by opening and closing the terminal connections. Activate the input as close to the process

transducer as possible to test the process wiring as far as possible. Manual operation of transducers, for example, limit switches can also give the required change for the input signals.

- Analog input signals: Use a signal generator for analog signals. A simple test coupling can be used as a voltage source. This can consist of a potentiometer across a suitable voltage source which gives +/- voltage. A current source, which can give sufficient current, for example, 20 mA, is required for current signals. Analog input test signals should be entered as close to the transmitter/transducer as possible to test the process wiring.

Digital and analog output signals are obtained by setting the required values from the overlaying controller.

Input Signals

Figure 2-21 shows where an input signal can be checked in an S800 I/O application.

DI modules provide a field input connector and DI channel LED's, and AI modules provide a field input connector.

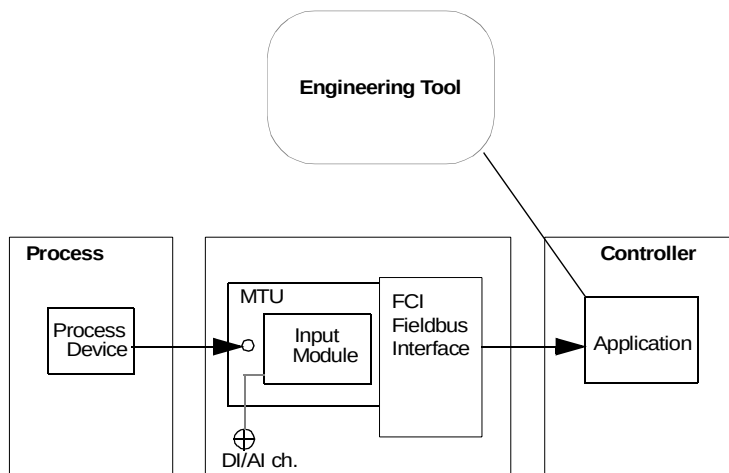


Figure 2-21. Block Diagram of S800 I/O Input Channel, Test Points

- **Digital Input Signals**

A digital input signal can be checked as shown in Figure 2-21. Use the following procedure as a guide:

- Simulate the digital input signal as close to the process transducer as possible or activate the transducer itself.
- Check that the corresponding yellow LED on the input module concerned illuminates and that the change is shown accordingly in the overlaying controller
- Change the input signal to a low level. Check that the yellow LED on the input board extinguishes and that the display value has changed.

- **Analog Input Signals**

Figure 2-21 shows where an analog input signal of an input channel can be checked. Proceed as follows to check an analog input channel:

- Simulate the analog input signal as close to the process transmitter/transducer as possible.
- Check that the simulated signal is available at the screw terminal of the corresponding connection.
- Check that the value shown on the display screen corresponds to the simulated value set in the field. Check the complete signal range.

Output Signals

Figure 2-22 shows where an output signal can be checked in an S800 I/O application.

DO Modules provide a field output connector and DO channel LED's.

AO Modules provide a field output connector.

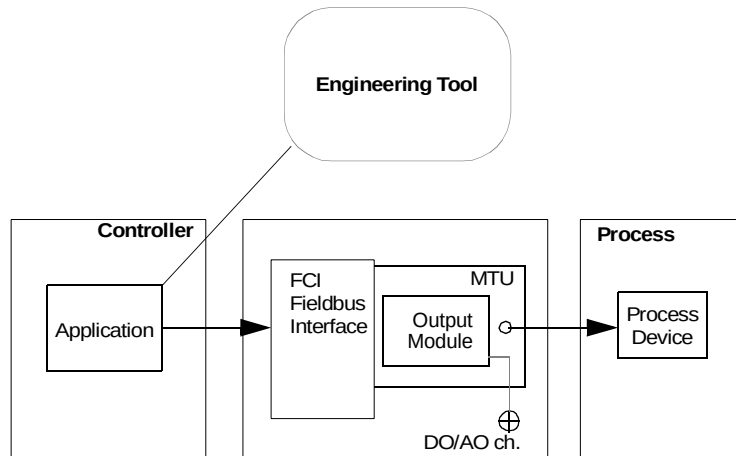


Figure 2-22. Block Diagram of S800 I/O Output Channel, Test Points

- **Digital Output Signals**

Typical digital output channels and where the signals can be tested are shown in Figure 2-22. Digital output signals in a specific plant are shown in the terminal diagrams for the plant.

Proceed as follows to check digital channels:

- Check that the corresponding output shows that it is set to on. Then check the value on the screw terminal block of the corresponding MTU, and if practical, at the process device also.
- Check that the corresponding yellow LED on the digital output module illuminates.

- **Analog Output Signals**

When checking analog output signals, use a multimeter to test for an output signal over the complete signal range.

Typical analog output channels and where the signals can be tested are shown in Figure 2-22. Analog output signals in a specific plant are shown in the connection diagrams for the plant.

Proceed as follows to check analog channels:

- Set the output value, and check that the corresponding output shows this value on the display. Then measure the value on the screw terminal block of the corresponding MTU, and if practical, at the process.
- When checking analog output signals use a multimeter to test that an output signal is obtained over the complete signal range.

2.4.2 Final Check

When the test of the control system is complete, and the plant functions satisfactorily, the following actions should be taken:

- Check that all S800 I/O modules are properly inserted in the MTUs.
- Check that all terminal screws on MTUs are properly tightened and that all grounds are good.
- Check that all cable connectors are properly mated.
- Check that all cable coverings or tie wraps are installed properly to avoid cable wear.
- Check that no tools or debris from installation remain in the cubicle. Clean the cabinet.

Chapter 3 Configuration

3.1 Before You Start

3.1.1 Design Considerations

This section provides guidelines and other information that you need to know before designing and configuring the S800 I/O. This information includes an overview of the hardware and database configuration guidelines.

3.1.1.1 I/O Station Layout Hardware Configuration Guidelines

The S800 I/O is DIN rail mounted. The rail can be any practical length to fit the needs of that particular I/O Station. A S800 I/O cluster can use a maximum of 2.5 meters (8.2 feet) on the rail. This is the maximum length of the ModuleBus from

the FCI, TB815 Interconnection Unit, or ModuleBus Modem to the ModuleBus terminator. See Figure 3-1 for maximum layout of station using Compact MTUs.

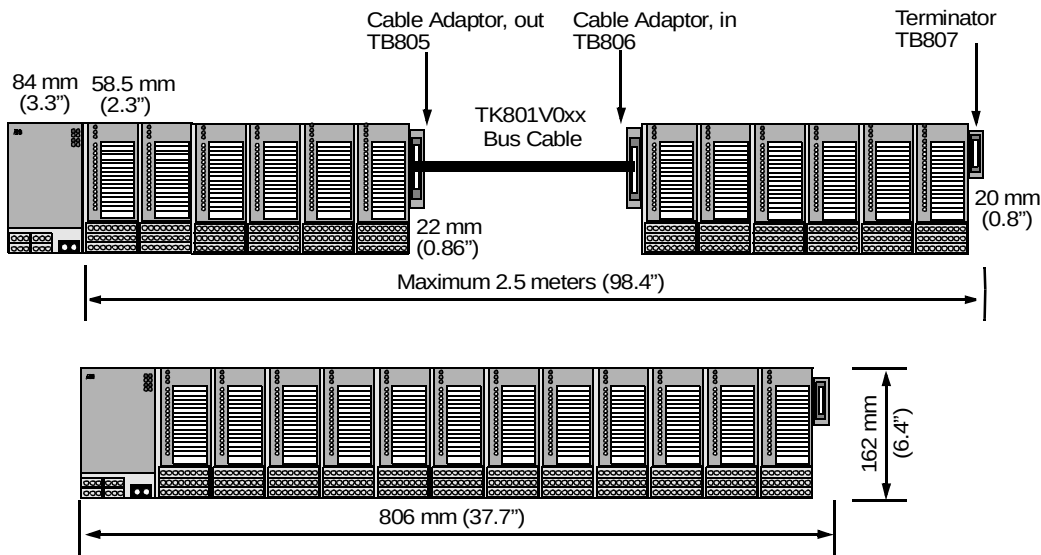


Figure 3-1. Maximum Layout of I/O Cluster with Compact MTUs

See Figure 3-2 for maximum layout of I/O cluster using Extended MTUs.

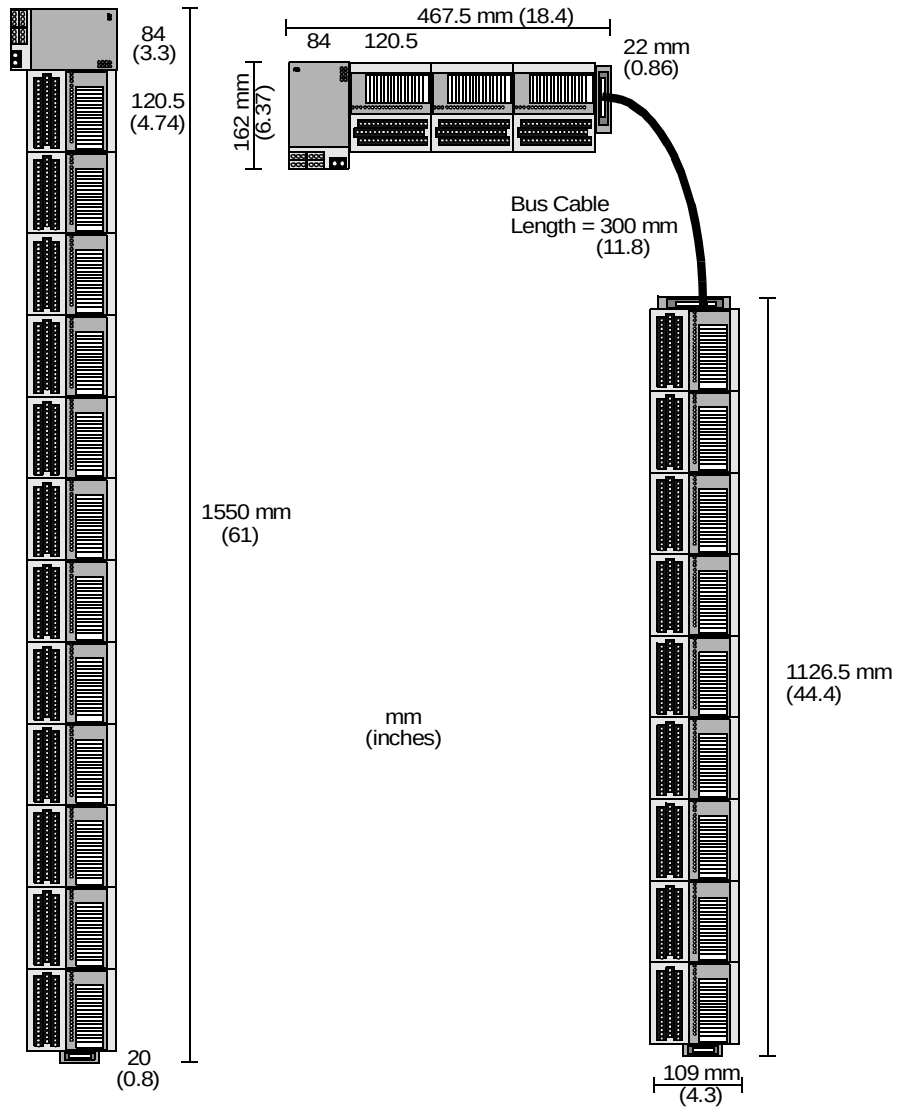


Figure 3-2. Maximum Layout of I/O Cluster with Extended MTUs

An I/O cluster may be divided into smaller parts to fit a particular requirement, but the 2.5 meter (8.2 feet) maximum must be observed at all times. The cluster may be distributed because of space limitations or to keep signal types together. See Figure 3-3 for an example of an I/O cluster divided up into four groups.

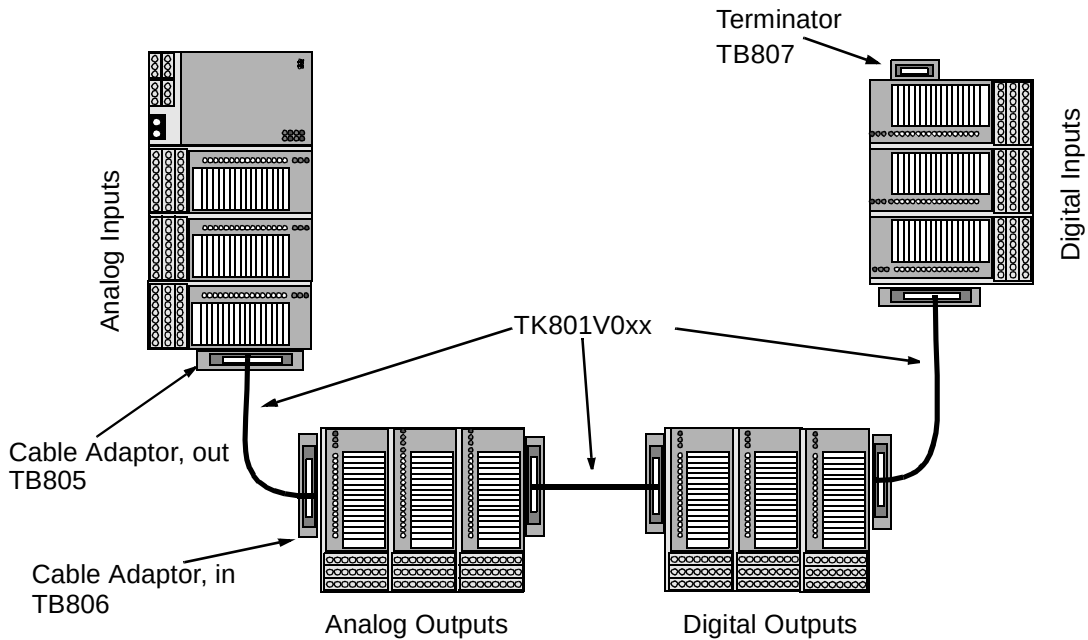


Figure 3-3. I/O Cluster in Small Groups

The first unit of the I/O Station is the Fieldbus Communications Interface (FCI). It connects to the fieldbus and is the communications interface to the I/O modules. The FCI controls the ModuleBus and provides power to the logic-side of the I/O modules. The FCI is a station on the fieldbus and must be set to the correct address. Refer to respective FCI manual for more information.

The FCI connects to the first MTU. Additional MTUs connect to each other or through the ModuleBus Extension cable, up to a maximum of 12. The ModuleBus is terminated by the TB807 Bus Terminator module. The I/O Modules are installed onto the MTUs and connected to the process in the field.

Redundant FCIs

An I/O Station with redundant CI820 FCIs requires that the ModuleBus Extension cable be connected to the TB815 Interconnection Unit and then to the first I/O Module. The maximum ModuleBus length from the TB815 to the ModuleBus terminator is 2.5 meters. See Figure 3-4 for layout of a station.

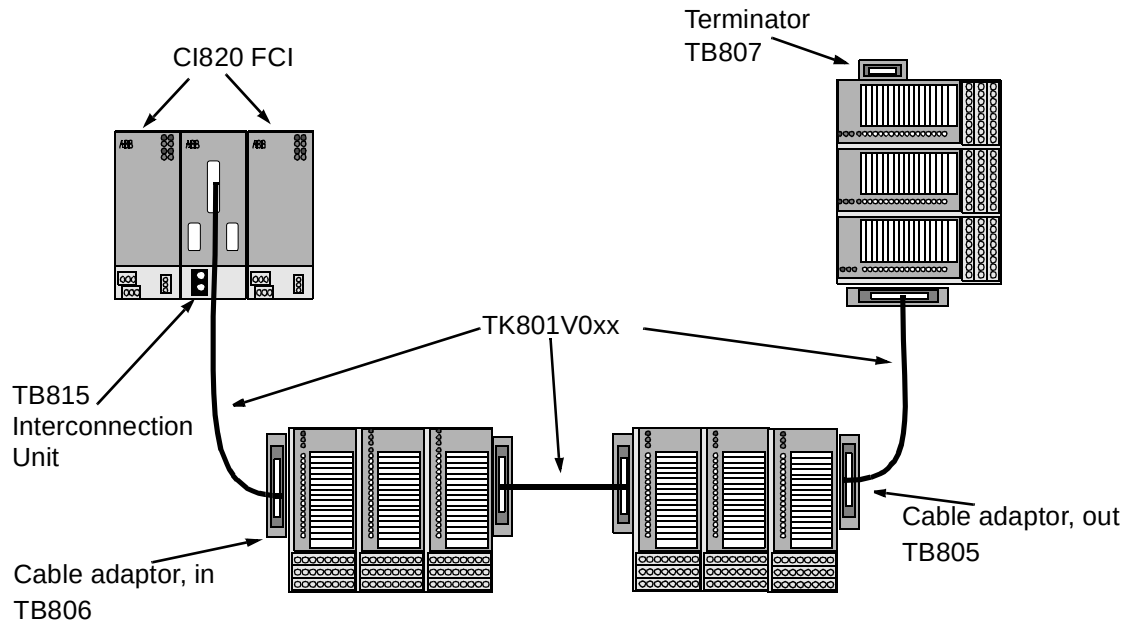


Figure 3-4. I/O Station with Redundant CI820 FCIs

I/O Clusters

I/O clusters 1-7 connect to the Optical ModuleBus port on the FCI or TB815 Interconnection Unit by Optical Expansion cables. Each I/O station can have up to 24 I/O modules and each I/O cluster can have up to 12 I/O modules. The 24V power supply has to be connected to each cluster. See Figure 3-5 for an example of optical ModuleBus Expansion cabling.

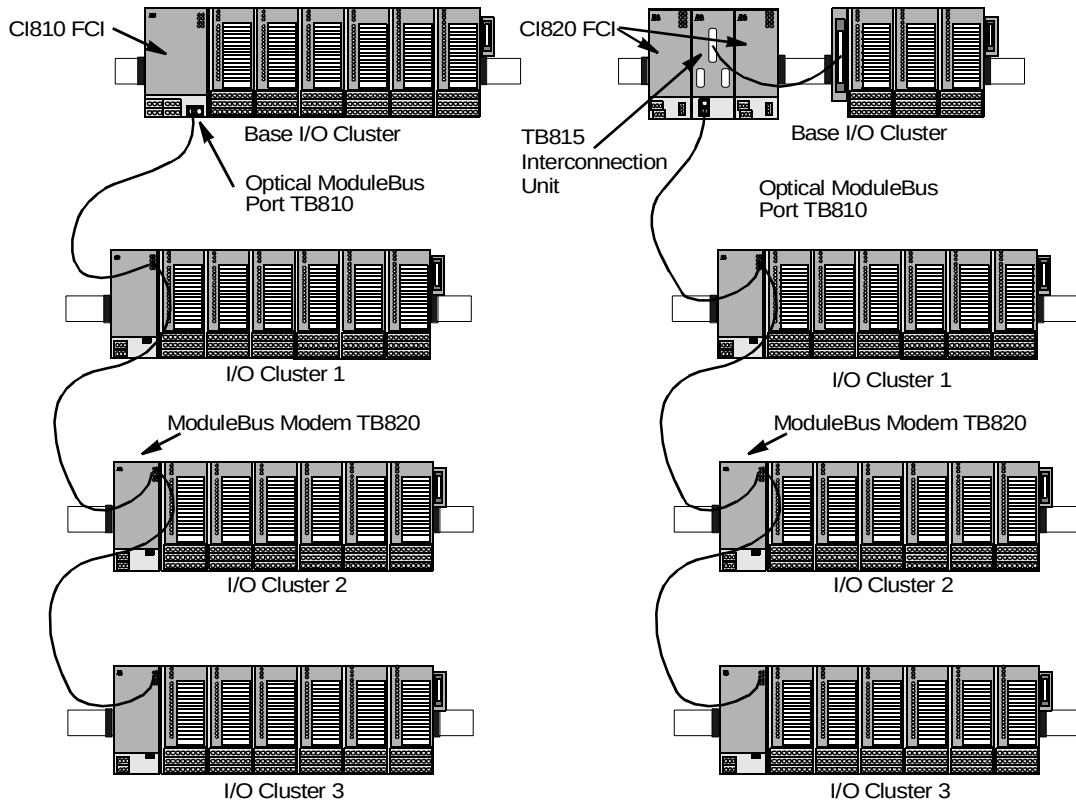


Figure 3-5. Optical ModuleBus Extension

3.1.1.2 CI810/CI820/CI830 FCI

The FCI needs to be connected to the Advant Fieldbus 100 or PROFIBUS-DP and have an address selected. It is also connected to a 24V d.c. power source to provide power to the I/O Station. Also refer to appropriate FCI manual for information on how to estimate the fieldbus and power loading of each I/O station configuration.

3.1.1.3 TB820 ModuleBus Modem

The TB820 ModuleBus Modem needs to be connected to the CI810/CI830 FCI, or the TB815 Interconnection Unit, and have an I/O cluster address selected. It is also connected to a 24V d.c. power source to provide power to the I/O modules of the cluster.

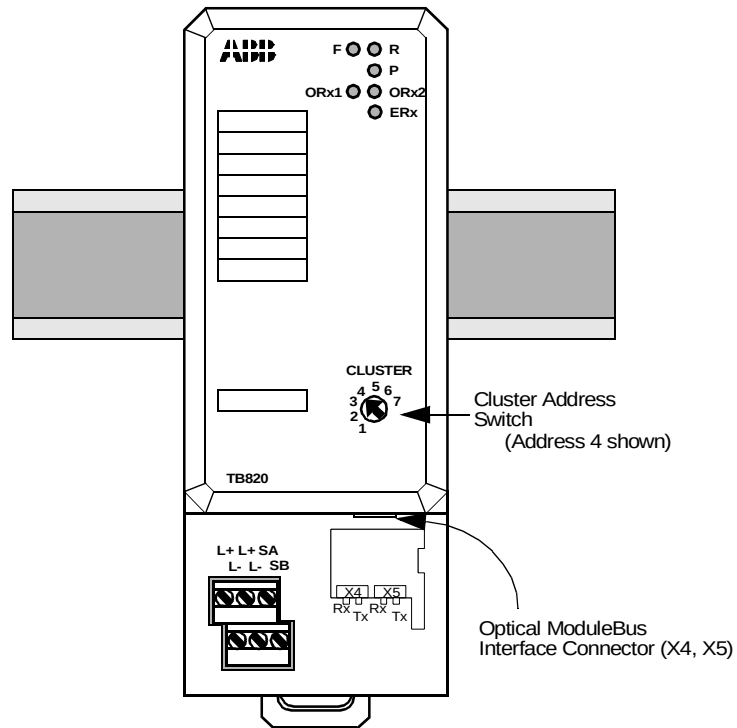


Figure 3-6. Front Panel of the TB820 ModuleBus Modem

Cluster Address Switch

The TB820 is equipped with a rotary switch used as the I/O cluster address selector for the I/O cluster. The I/O cluster address is in the range of 1 to 7. The FCI is base cluster address 0 (zero). Figure 3-6 shows the front panel of the TB820.



Care must be taken that no I/O clusters have the same address setting. This could result in output modules in the same ModuleBus position but in different I/O clusters putting out the same value



A new cluster address should not be set during operation. If the address changes during operation the cluster is disconnected from the ModuleBus, and no communications is possible with the I/O modules on that cluster address. The new address is set at reset or power up

Optical ModuleBus Connections

The TB820 has a connection to the optical ModuleBus by the optical ports on its front. The fiber optic cable(s) connect to the X4 (Tx and Rx ports) and X5 (Tx and Rx ports) connectors of the TB820. The optical ModuleBus can be connected to duplex or simplex fiber optic cables. See Figure 3-7 for connection details.

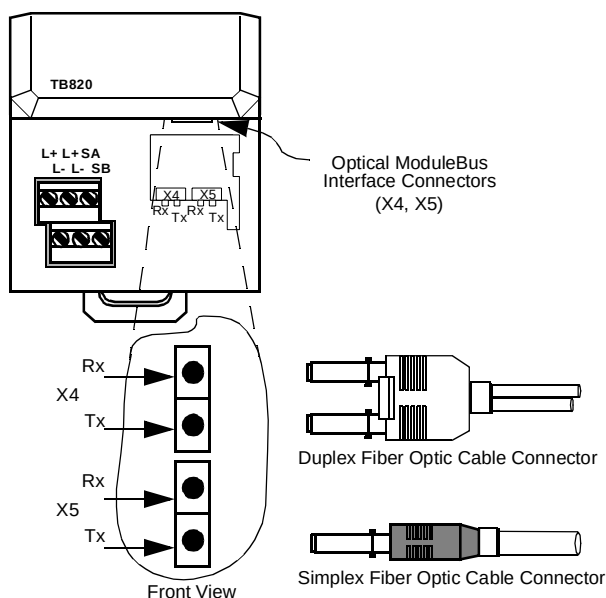


Figure 3-7. TB820 Optical ModuleBus Connections

The connector style, either simplex or duplex, all provide snap-in action when mated to the X4/X5 ports. Simplex connectors are color coded to facilitate identification of transmitter (Tx) or receiver (Rx) connections. Duplex connectors are keyed so that proper orientation is ensured during insertion.

Figure 3-8 shows a duplex, simplex and mixed configuration of the optical ModuleBus. Duplex (two-way) is normally the best communication design, but may not apply to all requirements. Duplex design allows additional TB820s to be added down-stream on-line.

Simplex (one-way) connections provide a ring configuration from the FCI to the first TB820, to the next TB820 and etc. and then back to the FCI. Simplex designs will require that the “home-run” cable from the last TB820 back to the FCI, or another TB820, be limited to the 15 meter (49 ft.) plastic fiber or 200 meter (667 ft.) HCS fiber cable length. The 15 meter (49 ft.) cable length or 200 meter (667 ft.) maximum applies from FCI to TB820, to TB820, etc. and back to the FCI.

Also, duplex and simplex configurations can be mixed in the same optical ModuleBus if required.

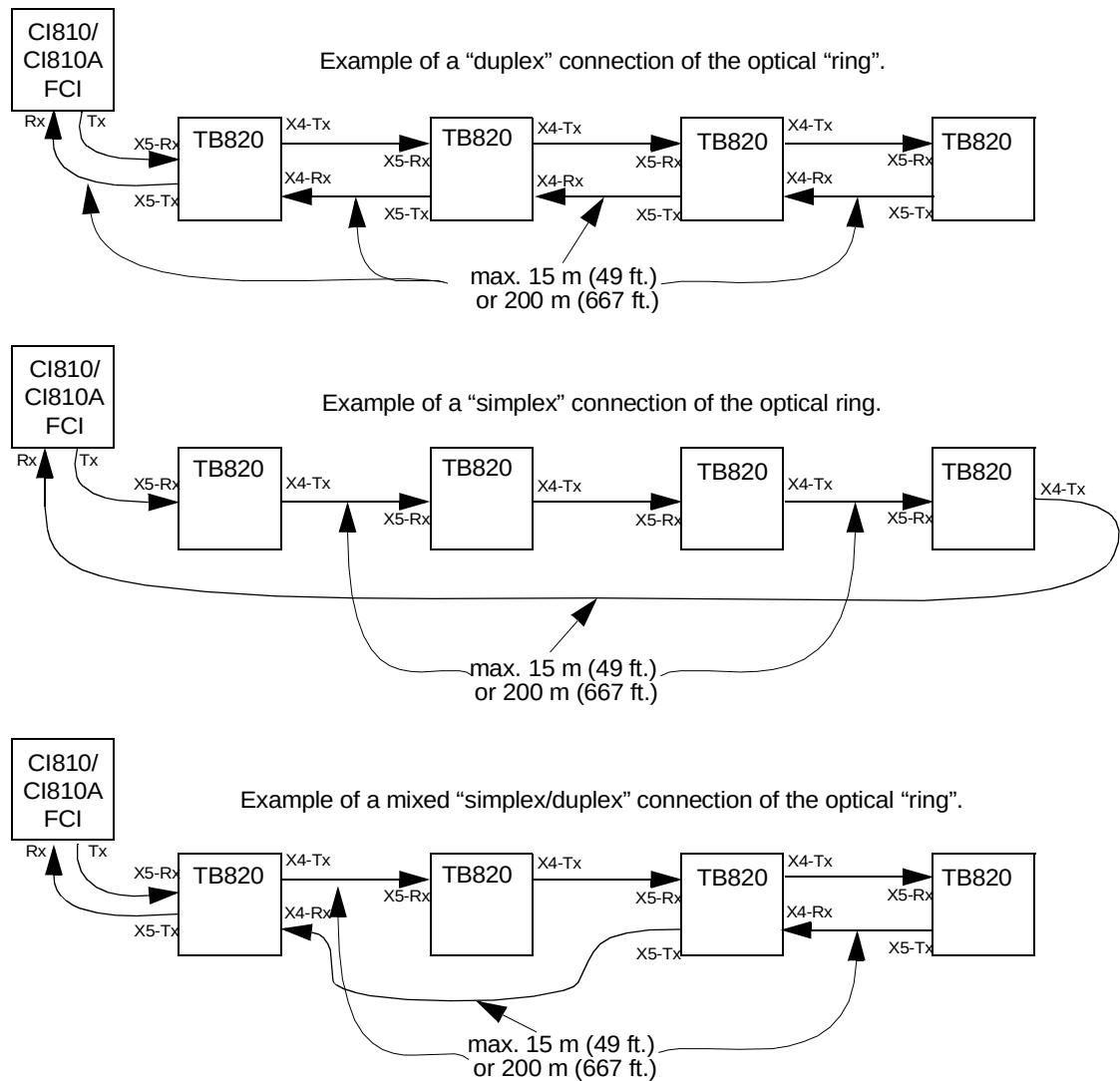


Figure 3-8. Typical Optical ModuleBus Designs

In a “duplex connection” a cable break or loss of a TB820 will only affect the clusters down-stream of the break. In a “simplex connection” a cable break or loss of a TB820 will affect all I/O expansion clusters on the ModuleBus.

Power Supply Connections

The TB820 requires 24V d.c. (19.2 - 30V) with a maximum current requirement of 1,4 Ampere. The TB820 can be powered by either a single or redundant power supply. If a redundant power supply is used, the TB820 can monitor the status of each supply and send the status back to the FCI of the I/O Station. See Figure 3-9 for power supply connections.

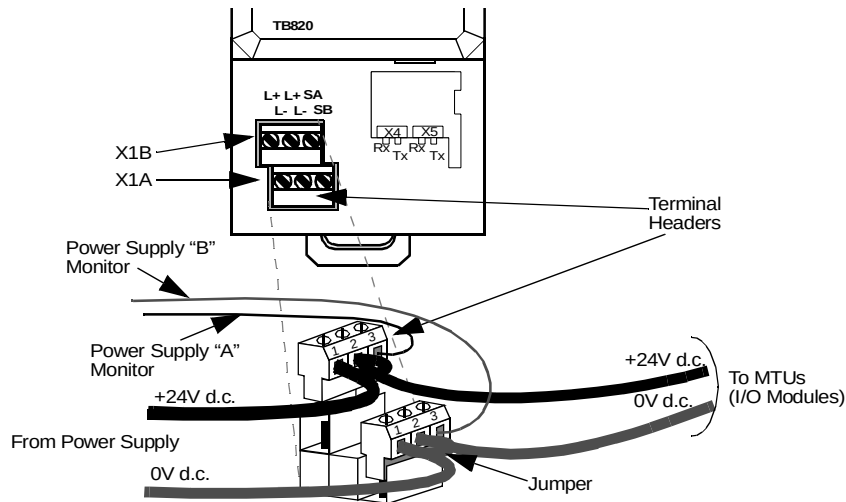


Figure 3-9. TB820 Power Supply Connections

The incoming power can then be distributed to other TB820s or the I/O modules if desired. Refer to Figure 3-11 and Figure 3-12 for power supply connection diagrams.



If the distributed power needs to be independent of whether the power plugs are removed or not, then the L+ and L- terminals should be bridged

Power connections can accept up to 0.2 - 2.5 mm² (24 - 14 AWG) wire size.
FCI power supply connections are presented in Table 3-1 and Table 3-2.

Table 3-1. TB820 Power Connection Terminal X1A

Pin	Designation	Description
1	L+	+24V d.c. Supply (can be jumpered to pin 2)
2	L+	+24V d.c. Supply
3	SB	Redundant Power Supply Monitoring Input

Table 3-2. TB820 Power Connection Terminal X1B

Pin	Designation	Description
1	L-	0V d.c. Supply (can be jumpered to pin 2)
2	L-	0V d.c. Supply
3	SA	Redundant Power Supply Monitoring Input

3.1.2 SD811 and SD812 Power Supply Configurations

The SD811 (24V d.c. @ 2.5A) and the SD812 (24V d.c. @ 5.0A) can be used alone or together for redundancy (Figure 3-10). The supplies can operate in a parallel configuration which can be used to increase the total output current capacity. The DCOK signal of the supplies can be connected to the supply monitoring inputs (SA, SB) of the FCI in the case of redundant supplies.

The SD811 provides enough power to support a fully loaded I/O Station.
 The SD812 is mainly used when field devices need to be powered.

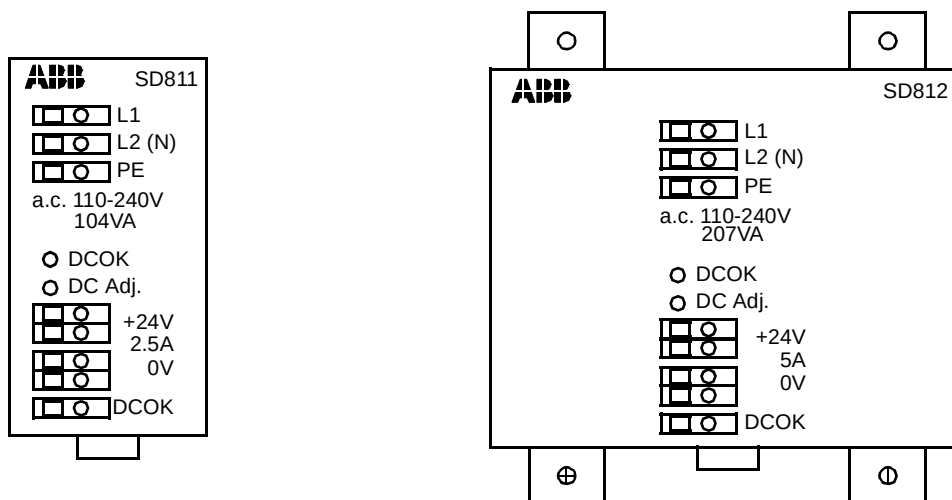


Figure 3-10. SD811 and SD812 Power Supply Connections

Figure 3-11 shows a typical wiring diagram for parallel operation when more capacity is needed. Figure 3-12 shows a wiring diagram for redundant mains.

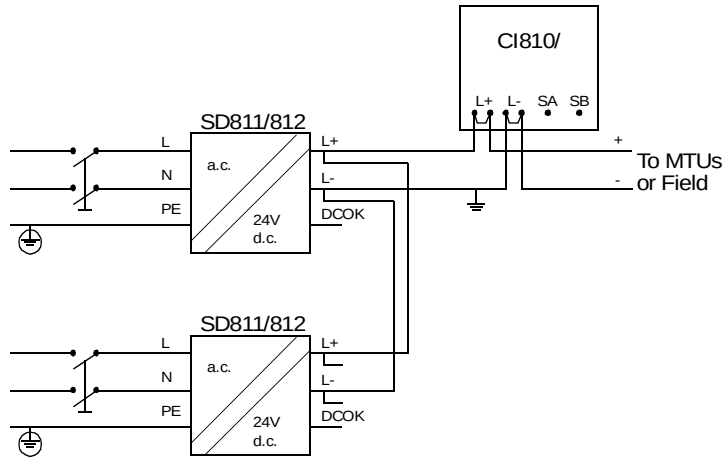


Figure 3-11. SD811 or SD812 Wiring Diagram for Parallel Operation

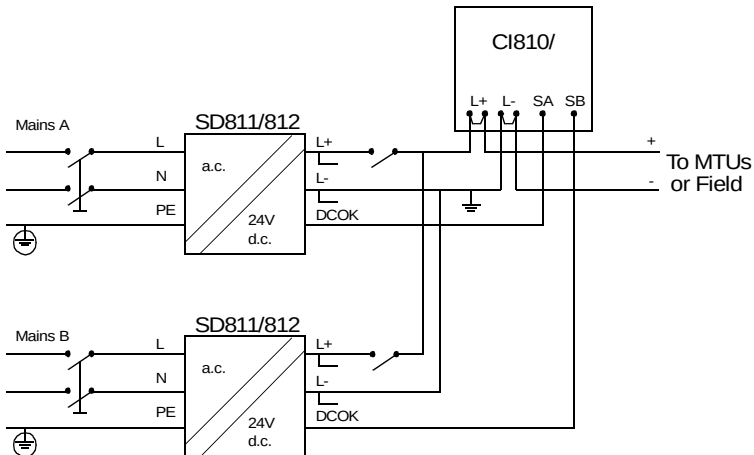


Figure 3-12. SD811 or SD812 Wiring Diagram for Redundant Mains

Figure 3-13 shows the connections to redundant CI820 FCIs.

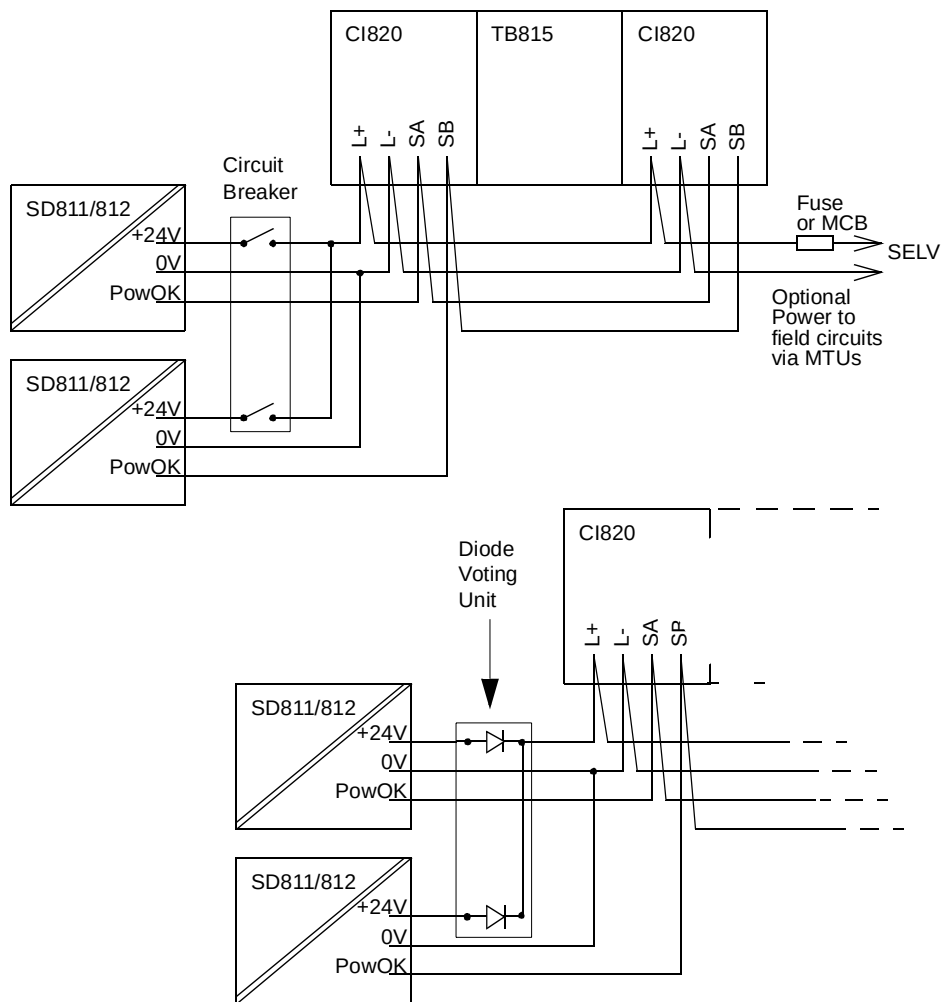


Figure 3-13. Connection Diagrams for Redundant Power Supplies to Redundant FCIs

This power supply can be utilized for non-redundant and redundant applications and does not require additional load-sharing control equipment such as diode voting units.



Circuit breakers or a diode voting unit at the power supplies output are required if hot replacement of supplies is required

3.1.3 Power Supply Load Calculation

Appropriate Hardware

Different power supply systems are available for the S800 I/O Station. The number of power supply units is calculated with respect to actual number of S800 I/O modules supported by the Station, see Section 3.1.7, Power Supply Requirements for details.

Normally you don't have to deal with current consumption calculations, however there are occasions with special requirements, or designs when detailed information regarding current consumption is valuable. Please find a description of special power supply usage under the guidelines below.

Guidelines

- A summary of the main requirements of the plant supply, from a planning point of view, is found in Section 2.1, Site Planning.
- Auxiliary equipment in the controlled system is normally powered separately from the S800 I/O power supplies.
- If field devices are grounded, be sure to use galvanic isolation.
- Heavy current on/off loads are **always** powered separately
- It is possible to use the system power supply for transmitters/transducers:
 - There is idle capacity in the available power supply units
 - The transducer is grounded directly in the control system chassis

Number of Power Supply Units/Power Consumption

The I/O Station requires 24V d.c. @ 1 amp for the FCI and 12 I/O modules. Additional power may be required for field devices.

3.1.4 Heat Dissipation

3.1.4.1 Cabinet Ventilation

To avoid overheating, when ambient temperatures are high, the heat dissipated in the electronics cabinet must be taken into consideration. This is particularly the case with sealed cabinets (IP54) or tropicalized cabinets (IP41).

The frequency of faults is estimated to be doubled for each 20°C increase in temperature. It is therefore important to maintain a low temperature where the equipment is installed.

The different hardware modules in the controller and the I/O system have different outputs of heat. Accurate calculation of the heat produced by the system requires knowledge of the modules and the work cycle.

3.1.4.2 Heat Dissipation Permitted in Cabinets

The maximum permitted temperature below the I/O station in the cabinet is 55 °C. The permissible amount of heat generated depends on the type of cabinet and its location.

In critical applications with an I/O station fully equipped and cabinets arranged in groups, it may be necessary to make a calculation of the actual power dissipation and an estimation of the temperature rise within the cabinet. It is recommended that you re-calculate when you expand the system as well.

3.1.4.3 Calculation of Heat Generated in a Cabinet

When calculating the heat generated in a cabinet, the heat generated by the different I/O modules must be summed, and then added to the heat generated by the power supply units and other equipment such as an extra modem, extra unit for supply of power to transmitters etc.

Section 3.1.8, Power and Cooling gives the power dissipated as heat by hardware modules in the S800 I/O system.

The total power dissipated in the cabinet can thus be written:

$$P_{Total} = (\sum P_{FCI}) + (\sum P_{IO}) + (\sum P_{Voltagesupplyunit}) + (\sum P_{Sundry})$$

P_{FCI} = Power of the FCI Module

P_{IO} = Power of each S800 I/O Module

$P_{Voltagesupplyunit}$ = Power loss of the power supply unit(s)

P_{Sundry} = Miscellaneous power using equipment installed in the cabinet.

3.1.5 Maintenance and Repair

From the maintenance point of view, use as few module types as possible in the hardware disposition of a control system. This is most relevant with the process I/O design. Standardization of I/O signal types and other electrical qualities is important to minimize the spare part stock.

Your solutions must make sense to the maintenance people in the event of disturbances and following trouble-shooting.

3.1.6 Expansion Considerations

A new S800 I/O station can be connected to an existing fieldbus without affecting other stations and controllers. The new I/O is automatically incorporated in the communication system. Spare connections must be pre-installed as to not disturb the existing bus.

The system fieldbus can be expanded in the following ways:

- Process I/O or MTU unit

New I/O modules can be added on line. It is recommended to have approximately 10 - 20% of total capacity as spare channels, and spare space in subracks.



Spare MTUs need to be pre-mounted to add I/O modules on-line.

3.1.7 Power Supply Requirements

A quick guide for power consumption to be used in a preliminary phase of a project work or whenever you need estimated figures is provided in Table 3-3.

Table 3-3. Estimated System Power Consumption

I/O Station	24V d.c. Power Consumption
Base Cluster (single FCI) and 6 I/O Modules	0.5A
Base Cluster (single FCI) and 12 I/O Modules	1.0A
Redundant FCIs (2) and 6 I/O Modules	1.0A
Redundant FCIs (2) and 12 I/O Modules	1.5A
Additional I/O Clusters and 6 I/O Modules	0.5A
Additional I/O Clusters and 12 I/O Modules	1.0A



The above estimates are based on an I/O Station with a mixed configuration of AI/AO and DI/DO. Only power consumption on the 24V d.c. distributed via the ModuleBus are included. External 24V connected directly to the I/O modules, for external loads and transmitters, are not included. When using large quantities of AO820s and/or DO820/DO821s, these load figures may be exceeded.

3.1.8 Power and Cooling

Table 3-4 shows the typical power and cooling values that can be used when designing the S800 I/O.

Table 3-4. I/O Station Power and Cooling (Typical)

Device	5 Volts ModuleBus	24 Volts ModuleBus	24 Volts External	Power Dissipation (Watts)	Cooling Load ⁽¹⁾ (BTU/H Typical)	Maximum Ambient Temperature
AI810	70 mA	40 mA	-	1.5	5.1	55/40°C (131/104°F) ⁽²⁾
AI820	80 mA	70 mA	-	1.7	5.8	55/40°C (131/104°F) ⁽²⁾
AI830	80 mA	80 mA	-	2.2	10	55/40°C (131/104°F) ⁽²⁾
AI835	75 mA	50 mA	-	1.6	5.4	55/40°C (131/104°F) ⁽²⁾
AI890	70 mA	-	200 mA	1.5	5.1	55/40°C (131/104°F) ⁽²⁾
AO810	70 mA	-	200 mA	3.0	10	55/40°C (131/104°F) ⁽²⁾
AO820	100 mA	200 mA	-	2.8	9.6	55/40°C (131/104°F) ⁽²⁾
AO890	70 mA	-	200 mA	3.1	10.4	55/40°C (131/104°F) ⁽²⁾
DI810	50 mA	-	-	1.8	6.1	55/40°C (131/104°F) ⁽²⁾
DI811	50 mA	-	-	2.7	9.2	55/40°C (131/104°F) ⁽²⁾
DI814	50 mA	-	-	1.8	6.1	55/40°C (131/104°F) ⁽²⁾
DI820	50 mA	-	-	2.8	9.6	55/40°C (131/104°F) ⁽²⁾
DI821	50 mA	-	-	2.8	9.6	55/40°C (131/104°F) ⁽²⁾
DI830	120 mA	-	-	2.3	7.8	55/40°C (131/104°F) ⁽²⁾
DI831	120 mA	-	-	3.2	10.9	55/40°C (131/104°F) ⁽²⁾
DI885	160 mA	91 mA ⁽³⁾	91 mA ⁽³⁾	3.0	10	55/40°C (131/104°F) ⁽²⁾
DI890	50 mA	-	50 mA	1.4	5.7	55/40°C (131/104°F) ⁽²⁾
DO810	80 mA	-	⁽⁴⁾	2.1	7.2	55/40°C (131/104°F) ⁽²⁾
DO814	80 mA	-	⁽⁴⁾	2.1	7.2	55/40°C (131/104°F) ⁽²⁾
DO815	130 mA	-	2 A ⁽⁵⁾	4.0	13.6	55/40°C (131/104°F) ⁽²⁾

Table 3-4. I/O Station Power and Cooling (Typical) (Continued)

Device	5 Volts ModuleBus	24 Volts ModuleBus	24 Volts External	Power Dissipation (Watts)	Cooling Load ⁽¹⁾ (BTU/H Typical)	Maximum Ambient Temperature
DO820	60 mA	140 mA	-	2.9	9.9	55/40°C (131/104°F) ⁽²⁾
DO821	60 mA	140 mA	-	2.9	9.9	55/40°C (131/104°F) ⁽²⁾
DO890	80 mA	-	250 mA	4.4	14.9	55/40°C (131/104°F) ⁽²⁾
DP820	120 mA	-	⁽⁴⁾	2.5	8.5	55/40°C (131/104°F)
CI810	-	-	110 mA	2.6	8.9	55°C/(131°F)
CI820	-	-	250 mA ⁽⁶⁾	6.0	20	55°C/(131°F)
CI830	-	-	110 mA	2.6	8.9	55°C/(131°F)
TB810	100 mA	20 mA	-	0.5	1.7	55°C/(131°F)
TB811	100 mA	20 mA	-	0.5	1.7	55°C/(131°F)
TB820	-	-	100 mA	2.4	8.2	55°C/(131°F)
SD811	-	-		11	37	55°C/(131°F) ⁽⁷⁾
SD812	-	-		22	75	55°C/(131°F) ⁽⁷⁾

- (1) Cooling load is the heat (BTU/H) produced by the equipment that may be required to meet room or enclosure cooling specifications.
(2) 40°C (104°F) applies to Compact MTUs with I/O modules mounted on a vertical DIN rail.
(3) 24V from ModuleBus (91 mA) or 24V external (91 mA) or 48V external (22 mA).
(4) 500 mA per channel with maximum load per channel.
(5) 2A per channel with maximum load per channel.
(6) CI820 in redundant configuration 2 x 250 mA
(7) Horizontal mounting only.

Calculation of 24V d.c. Power Consumption

Total 24V d.c. power consumption = Σ 24V load ModuleBus + Σ 5V load
ModuleBus*0.3 +

Σ 24V external load.

The calculated 24V ModuleBus load should not exceed 1.3A.

Chapter 4 Operation

4.1 Operating Overview

An I/O station is an autonomous station which normally is not handled by an operator. Of course, it is started and sometimes stopped manually. This is done, however, in specific situations such as the time of installation work and maintenance.

Accordingly, operating instructions are spread out in this manual. See where the specific activity is treated.

For general descriptions, see the beginning of this chapter. For concrete instructions, see Chapter 2, Installation and Chapter 5, Maintenance.

Please see the controller manual or the *S800 I/O Fieldbus Communication Interface for PROFIBUS-DP* or *S800 I/O Fieldbus Communication Interface for Advant Fieldbus 100* manuals.

Chapter 5 Maintenance

5.1 Preventive Maintenance

This chapter describes routine maintenance, replacement and installation procedures necessary to maintain the operation of the S800 I/O equipment. The S800 I/O modules do not need special adjustments such as zero and span of analog I/O modules.

Analog I/O modules are factory calibrated and have calibration parameters for all ranges stored in memory on the module. The FCI uses those calibration parameters for calculations of the correct input and output signals.

Thermocouple and RTD modules use internal references for calibrations of the measured values.

5.2 Hardware Indicators

Various visual indications (LEDs) are used in the I/O-system. Some common examples are:

- Run indication of the device
- Error indication of the device
- Warning indication of the device (only on I/O modules)
- Status display of digital inputs or outputs
- OSP indication on output modules.

These indications serve the purpose of informing the user about status or fault in the system or in the process. They are intended to be a simple and easy to use help. They should allow to spot faults in the station easily.

5.2.1 Color

A fixed meaning is assigned to the colors red, yellow and green:

RED	Danger or alarm	Warning of potential danger or a situation which requires immediate action
YELLOW	Caution	Change or impending change of condition, warning
GREEN	Safety	Indication of a safe situation or authorization to proceed, clear way.

For digital I/O on-states a definite meaning can not be assigned. For them the color yellow is chosen. The Table 5-1 shows the meaning and colors of LED's.

Table 5-1. Meaning and Colors of LED's

Meaning/Purpose	Color	Examples
Fault; Error	Red	"FAULT"
Warning, I/O State Indications and OSP (Outputs Set as Predetermined)	Yellow	OSP, Process error, Digital I/O on-state, Process voltage low, Traffic.
Normal Operation	Green	"RUN", Normal operation, Power OK.

5.2.2 Location

For the location of LEDs the following rules are applied:

- Indications having the same meaning on every I/O module (for example, FAULT, RUN, WARNING, OSP) are at the same position.
- The standard indications FAULT, RUN, WARNING and OSP (only output modules), are always on the topmost position on every device (top: FAULT, RUN, then WARNING, OSP).
- On the FCI: FAULT, RUN, POWER OK, TRAFFIC and for redundant FCI also PRIMARY and REDUNDANCY OK.

5.2.3 Identification

LED's shall be identified by an appropriate symbol or abbreviation of an English term. For the standard indications the abbreviation is as follows:

- | | |
|---|---------------------------|
| • Fault in the module | FAULT or F |
| • Device is in operation | RUN or R |
| • External fault or minor fault in the module | WARNING or W |
| • Output Set as Predetermined, | OSP or O |
| • Digital I/O on-state | 1, 2,... (channel number) |
| • Digital I/O channel | FAULT or F |
| • Power supply ok internal and/or external ok | POWER OK or P |

5.3 Error Messages

Not applicable.

5.4 Fault Finding and User Repair

5.4.1 Introduction

Diagnostics are available in different forms for rapid localization of the source of the equipment malfunction. Hardware error is usually corrected by replacing the faulty module which is returned to ABB Service for repairs. The smallest replaceable unit is normally a module or an apparatus like a power supply unit.

Disturbances and system halt caused by software error is commonly solved by a manual system restart.

External faults in process wiring and transducers can also affect the function of the S800 I/O system. However, this type of fault is not discussed in this manual.

5.4.2 Diagnostics and Fault Indications

Hardware and software in a S800 I/O system is provided with supervision against system faults.

LED indicators on modules:

- Green LED, RUN, indicates normal function.
- Yellow LED indicates an active signal, for example, status of digital input (DI) or digital output (DO), OSP and Warning
- Red LED, FAULT, indicates malfunction

5.4.3 List of General Fault Finding Procedures and Hints

5.4.3.1 Location of Malfunction

Sometimes, you lack the information from the controller diagnostics, that tells you where the fault is located. Suspicion about a fault is raised by the process behavior.

Experience indicates that approximately 85% of all faults occur in the process, 10% in the control program and 5% in the control system hardware.

It is always advisable to localize the malfunction with these figures in mind to minimize the down-time.

5.4.3.2 External Factors

In an electronics system which has given satisfactory service, most malfunctions have external causes. It is therefore important, when tracing a fault, to determine if any external factor such as incorrect handling of the equipment, short circuits, welding work, lightning strike and/or power failure has caused the malfunction.

5.4.3.3 Safety at Start/Stop

Voltage failure, component fault or manual restart usually affect the control system function. I/O system failure affects the process in different ways:

- In a system which is monitoring the process only, changes in the process status are not registered but there is no immediate danger to the process operation.
- In a system which is controlling a continuous processes (rolling mills and paper manufacture) demands a high degree of continuity of the control system functions.



A restart of the I/O system or controller can have very serious consequences. It is important to be aware of the local requirements for safety when starting and stopping the I/O system or controller.

5.4.3.4 Check of Power Supply

Check of Non-redundant Power Supply

The CI810/CI830, CI820 Fieldbus Communications Interface (FCI), or TB820 status LED - P is illuminated when 24V d.c. is supplied to the FCI, and 5V (from the FCI) is supplied to the rest of the I/O Station.

The supply system consists at least of one power supply.

Power can be checked at the FCI or TB820 on terminals L+ and L- with a voltmeter. The value should be 24V d.c. (19.2 to 30). Power can also be checked at the power supply or on the distribution strip.

Check of Redundant Power Supply

The CI810/CI830, CI820 Fieldbus Communications Interface (FCI), or TB820 status LED - P is illuminated when 24V d.c. is supplied to the FCI, and 5V (from the FCI) is supplied to the rest of the I/O Station.

The supply system consists at least of two power supplies.

Power can be checked at the FCI or TB820 on terminals L+ and L- with a voltmeter. The value should be 24V d.c. (19.2 to 30). Power can also be checked at the power supplies, diode unit or on the distribution strip.

To do a complete check each power supply has to be run as single.

5.4.4 User Repair

5.4.4.1 I/O Module Replacement

General

All I/O modules, except for relay output modules with normally closed contacts, can be exchanged on-line and with the process power supply connected. This is possible because the module deactivates when the I/O module lock switch is turned to unlock.

It is important to understand the consequences of a module exchange on-line and how it affects the process. Replacement of an S800 I/O module affects all channels on the module. It also sometimes indirectly affects the outputs via some application function, on another module.

The system software in the FCI checks automatically that all I/O modules function correctly. In the event of module fault, and module exchange, the module and associated signals are marked as faulty.

The system software checks that the module is inserted and correct. If this is the case, the Fault-indicator (LED) extinguishes (after 10 seconds).

5.4.4.2 Power Supply Module Replacement

General

In single or parallel operation of power supplies, there will always be a disturbance of the function when a power supply must be replaced; the station will not have power.

In a redundant power supply configuration, it is possible to replace a power supply module without disturbance of the function. To achieve that the installation see Section 3.1.2, SD811 and SD812 Power Supply Configurations and the correct replacement procedure that follows.

Practical Execution

Replace faulty or suspect power supply module in the following way:

For single or parallel operation do steps 1, 2 and 4 to 13.

For redundant configuration do steps 1 to 14.

1. Read Section 2.2.1, Safety Regulations.
2. Check that the new module can replace the old.
3. Switch off the output from the module (only redundant configuration).
4. Switch off input power to the module.
5. Disconnect the wires.
6. Unmount the module by loosening the module locking.
7. Mount the new module.
8. Connect the input wires.
9. Switch on input power to the module.
10. Perform a function test on the new module.
11. Switch off input power to the module.
12. Connect the output wires.
13. Switch on input power to the module.
14. Switch on the output from the module (only redundant configuration).

5.4.4.3 Communication Module Replacement

General

Normally communications modules can't be exchanged on-line, the only exception is the CI820 in a redundant configuration.

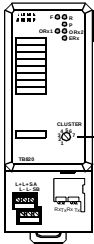
It is important to understand the consequences of a module exchange and how it affects the process.

- Replacement of a communication module type CI810/CI830 or a CI820 in a single configuration affects all channels on all the modules in an I/O station. The station will loose power.
- Replacement of a single communication module type CI820 in a redundant configuration has no affects on channels in an I/O station.
- Replacement of a communication module type TB810/TB811 affects all channels on all the modules in all clusters except cluster 0. The communication will be broken to all clusters except for cluster 0.
- Replacement of a communication module type TB815 affects all channels on all the modules in an I/O station. The station will loose power.
- Replacement of a communication module type TB820, connected via a simplex optical cable, affects all channels on all the modules in all clusters except cluster 0. The communication will be broken to all clusters except for cluster 0. The cluster where the TB820 should be replaced will be power less.
- Replacement of a communication module type TB820, connected via a duplex optical cable, affects all channels on all the modules in all clusters after and including the cluster where the replaced TB820 is located. The communication will be broken to all clusters after where the replaced TB820 is located. The cluster where TB820 should be replaced will be power less.

Additional Aspects on Individual S800 Communications Modules

Table 5-2 lists S800 I/O modules. Descriptions of these types are referred individually in the table.

Table 5-2. Replacement Aspects of S800 I/O Modules

Module Type - Settings	Comments
TB810/811 No settings	Optical ModuleBus cable can be removed by pulling the connector(s) out of the unit. Extract the module.
TB820 Module- Bus Modem  Cluster Address Switch	Can not be replaced with power applied. Needs room to the left of an MTU in order to be removed. In normal operation mode, before a TB820 is replaced, the supply to the S800 I/O is to be switched off. Power connections can be removed by pulling the header terminals out of the unit. Optical ModuleBus connections can be removed by pulling the connector(s) out of the unit.

Appendix A References

A.1 SD811/SD812 Power Supply Module, 24V d.c.

Features

- SD811 24V d.c. @ 2.5A
- SD812 24V d.c. @ 5.0A
- Input 110 - 240V a.c. (45 - 65 Hz), or 185 - 250V d.c.
- Power OK status indicator and output signal
- DIN-rail mounted.

Description

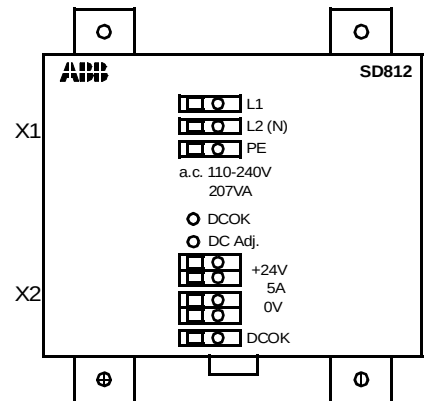
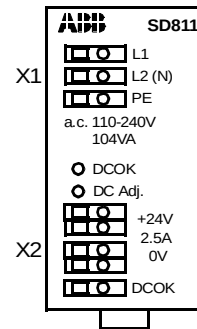
The SD811 Power Supply Module provides 24V d.c. at 2.5A and the SD812 Power Supply Module provides 24V d.c. at 5.0A.

The SD811(SD812) is a switch-mode power supply unit converting main voltage to 24 Volts d.c. This power supply can be utilized for non-redundant and redundant applications and does not require additional load-sharing control equipment or diode voting units.

Two or more power supply devices can be connected in parallel. No special efforts are included to get the paralleled devices sharing the load equally. Connecting units in parallel can be used for increasing the power output or to get n+1 redundancy.

Normal function, DCOK, is indicated by a green Light Emitting Diode (LED).

Status Signal, DCOK terminal, Power Good = active high; 24V source with a series resistance = 270 ohms, signal return = 0V



Signal voltage output (in parallel with DCOK LED) is derived from the output terminal voltage, but the device signal status is independent of external voltage injection from power supply units connected in parallel.

The output voltage is adjustable within the range 22.5 Volts to 28.5 Volts, and is factory set at 24 Volts $\pm 1\%$.

Primary voltage setting needs no selection or adjustment, the full voltage range specified is covered by the design.

The modules can be mounted on a standard DIN rail. It has a mechanical latch that locks it to the DIN rail. The latch can be released with a screwdriver.

Technical Data

Table A-1. SD811/SD812 Power Supply Module Specifications

Item	SD811 Value	SD812 Value
Output	24V d.c. @ 2.5A	24V d.c. @ 5.0A
Mains input voltage	110 - 240V a.c. 185 - 250V d.c.	110 - 240V a.c. 185 - 250V d.c.
Mains frequency a.c. d.c.	45 - 65 Hz 0 Hz	45 - 65 Hz 0 Hz
Rated input power, a.c. Power factor	104 VA 0.67 typical	207 VA 0.67 typical
Rated input power, d.c.	70 Watts	140 Watts
Rated output power (at 24V)	60 Watts	120 Watts
Efficiency (50 - 100% loading)	0.85	0.85
Power dissipation (full load)	11 W	22 W
Over-voltage protection	35V d.c.	35V d.c.

Table A-1. SD811/SD812 Power Supply Module Specifications (Continued)

Item	SD811 Value	SD812 Value
Rated Input Current 230V a.c. 110V a.c. 220V d.c.	0.45A 0.8A 0.32A	0.9A 1.6A 0.65A
Power on surge current	3.5A	7A
Primary power protection	Fusable links	Fusable links
Output power protection	Electronic short-circuit protection	Electronic short-circuit protection
Ambient temperature Transport (max) Storage (max) Operating (nominal)	-25°C to 70°C (-13°F to 158°F) -25°C to 55°C (-13°F to 131°F) 5°C to 55°C (41°F to 131°F)	-25°C to 70°C (-13°F to 158°F) -25°C to 55°C (-13°F to 131°F) 5°C to 55°C (41°F to 131°F)
Relative humidity	10% - 75%	10% - 75%
Approvals	Also meeting the requirements for a CE mark based upon the Low Voltage Directive 73/23/EEC; requirements referring to EN 50178 including EMC capabilities meeting the EN 50081-2, EN 50082-2.	Also meeting the requirements for a CE mark based upon the Low Voltage Directive 73/23/EEC; requirements referring to EN 50178 including EMC capabilities meeting the EN 50081-2, EN 50082-2.
Safety classification	Class I according to IEC 536; (earth protected)	Class I according to IEC 536; (earth protected)
Protection rating	IP20 according to IEC 529, (IEC 144)	IP20 according to IEC 529, (IEC 144)
Rated insulation voltage	300V	300V
Dielectric test voltage	2,2kV a.c.	2,2kV a.c.
Width	50 mm (2")	125 mm (5")

Table A-1. SD811/SD812 Power Supply Module Specifications (Continued)

Item	SD811 Value	SD812 Value
Depth	130 mm (5.1")	138 mm (5.4")
Height	102 mm (4")	134 mm (5.25") with mounting ears

Connections

Table A-2. SD811/SD812 Primary Power Connections

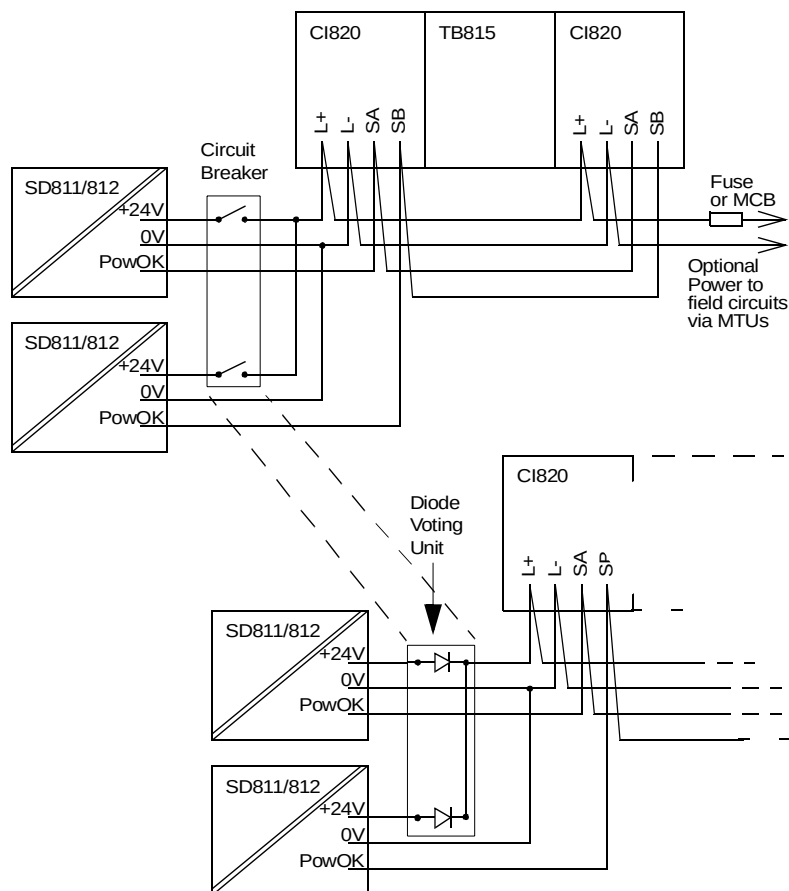
Terminal	Description
X1 - L1	Mains power Line
X1 - L2 (N)	Mains power Neutral
X1 - PE	Mains power ground (Protected Earth)

Table A-3. SD811/SD812 Output Power Connections

Terminal	Description
X2 - 1	24V d.c.
X2 - 2	24V d.c.
X2 - 3	0V
X2 - 4	0V
X2 - 5	DCOK Status Signal

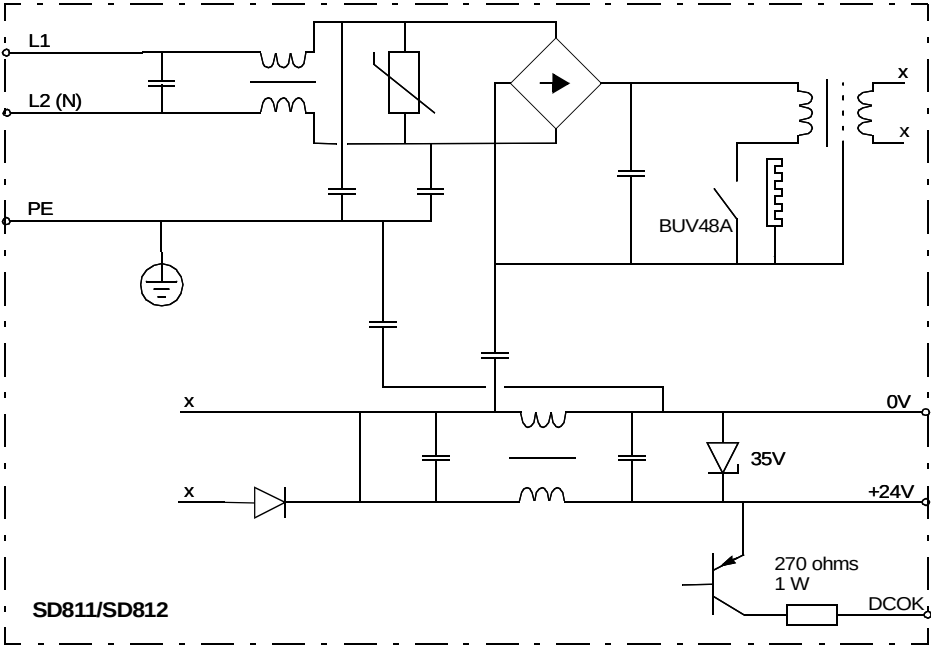
Connection diagram

The diagram shows the connections needed for redundant power supplies to redundant FCI's with power supply hot swap possibilities.



Circuit breakers or a diode voting unit at the power supplies output are required if hot replacement of supplies is required.

Block Diagram SD811/SD812



A.2 TB805/TB806 ModuleBus Cable Adapter-Out/In

Features

- Passive unit used for connection and extension of the ModuleBus
- DIN rail mounting.

Description

The TB805 ModuleBus Cable Adaptor-Out and TB806 ModuleBus Cable Adaptor-In with the ModuleBus Extension Cables, TK801V0xx, are used to extend the ModuleBus.

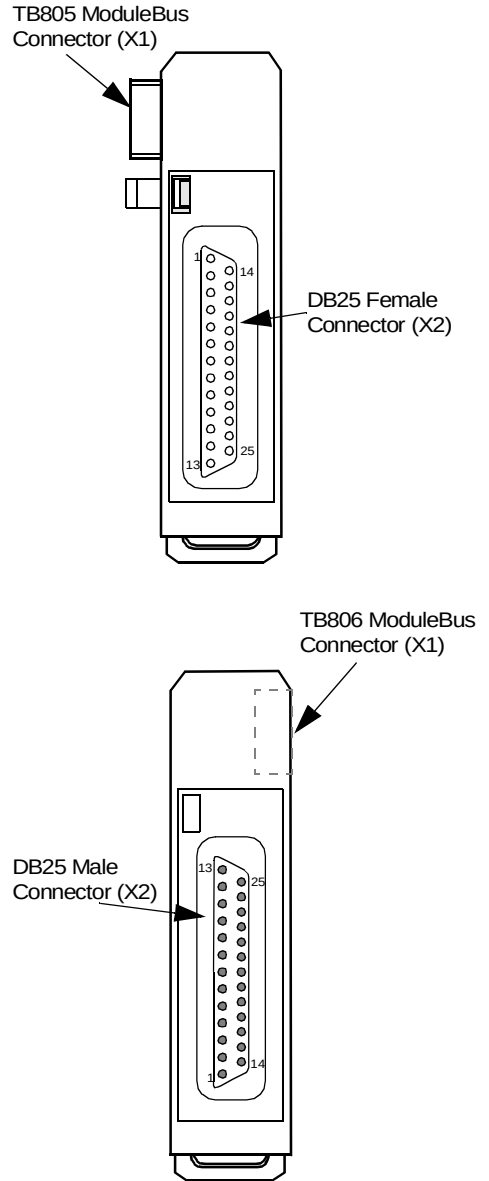
Using the TB805 and TB806, I/O modules on the same electrical ModuleBus of an I/O cluster, can be mounted on different DIN rails. This makes the installation of I/O Modules more flexible when laying out an enclosure design. Please refer to Section 2.1.4.1, I/O Station with S800 I/O for details on layouts.

The ModuleBus extension cables used with the TB805/TB806 comes in 3 standard lengths:

- VTK801V003 - 300 mm
- TK801V006 - 600 mm
- TK801V012 - 1.2 meters.

Overall ModuleBus length must not exceed 2.5 meters including all cables and MTUs.

The TB805/TB806 mounts on the standard DIN rail. It has a mechanical latch that locks it to the rail. It is grounded to the DIN-rail through a metallic spring connector. The latch can be released with a screwdriver.

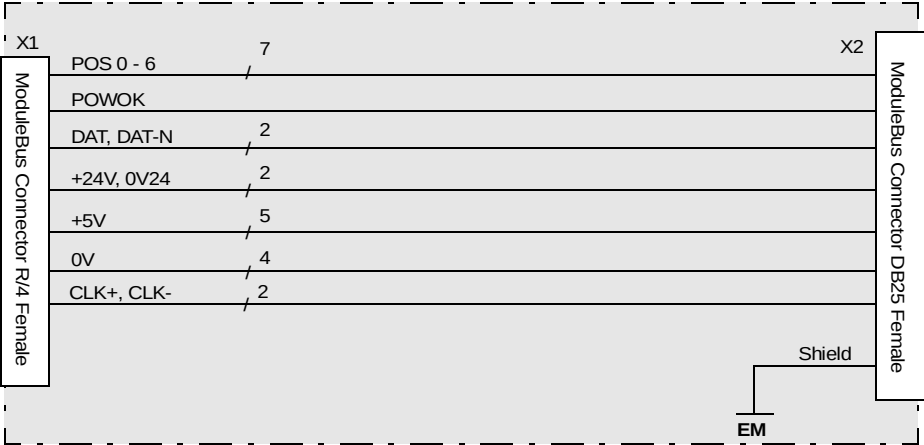


Technical Data

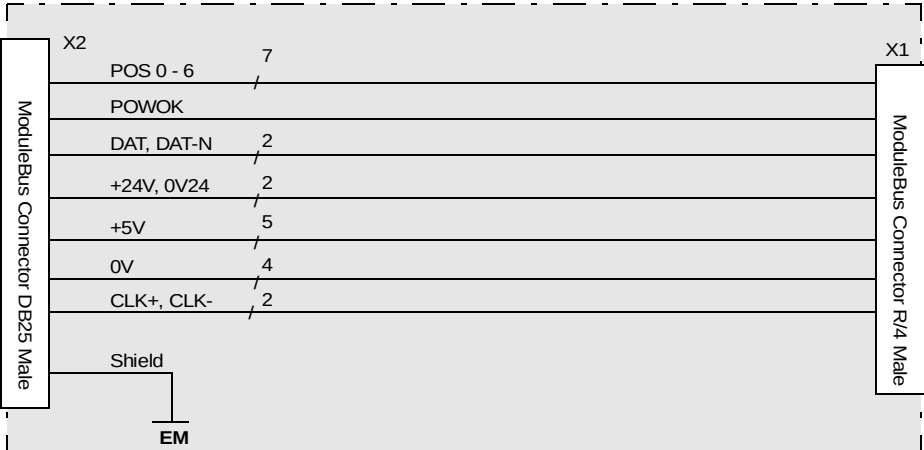
Table A-4. TB805/TB806 ModuleBus Cable Adaptor Specifications

Item	TB805	TB806
Direction	Out	In
Connections	2 DIN41612 Type R/4 (X1) DB25 Female (X2)	2 DIN41612 Type R/4 (X1) DB25 Male (X2)
ModuleBus: Maximum 5V current distribution Maximum 24V current distribution	1.5A 1.5A	1.5A 1.5A
Module catch	Locks module to previous device	Locks module to previous device
Module DIN rail lock	Locks module and provide ground connection	Locks module and provide ground connection
Safety Classification	Class I according to IEC 536; (earth protected)	Class I according to IEC 536; (earth protected)
Protection Rating	IP20 according to IEC 529, (IEC 144)	IP20 according to IEC 529, (IEC 144)
Rated Insulation Voltage	50V	50V
Dielectric test voltage	500V a.c.	500V a.c.
Width	22 mm (0.88")	22 mm (0.88")
Depth	25 mm (0.98")	25 mm (0.98")
Height	109 mm (4.3")	109 mm (4.3")
Weight	55 g (0.12 lbs.)	55 g (0.12 lbs.)

Block Diagram TB805



Block Diagram TB806



A.3 TB807 ModuleBus Terminator

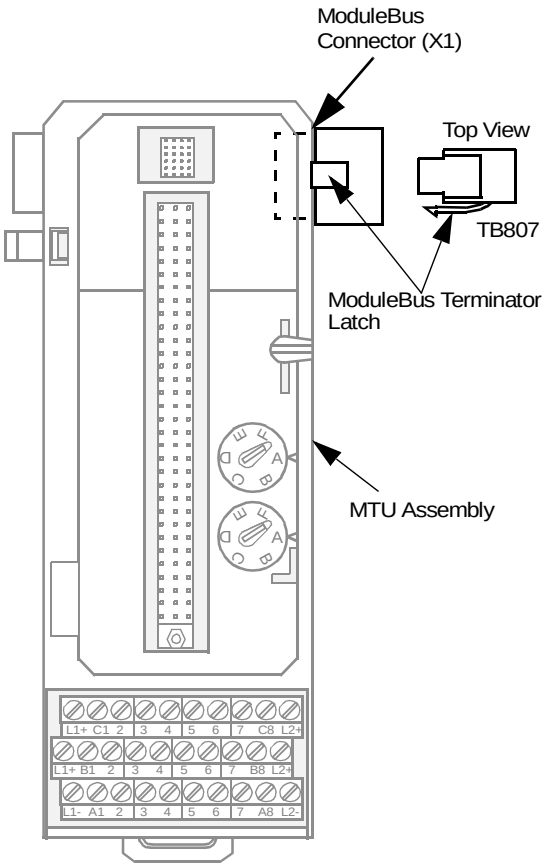
Features

- Passive unit used for termination of the electrical ModuleBus.

Description

The TB807 ModuleBus Terminator is used to terminate the electrical ModuleBus.

Use the TB807 to terminate the electrical ModuleBus of an I/O cluster. The ModuleBus terminator connects to the outlet ModuleBus connector of the last MTU.

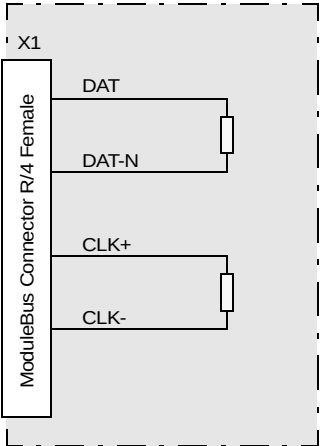


Technical Data

Table A-5. TB807 ModuleBus Terminator Specifications

Item	Value
Connections	1 DIN41612 Type R/4 (X1)
Module catch	Attaches module MTU
Safety Classification	Class I according to IEC 536; (earth protected)
Protection Rating	IP20 according to IEC 529, (IEC 144)
Rated Insulation Voltage	50V
Dielectric test voltage	500V a.c.
Width	13 mm (0.5")
Depth	19 mm (0.7")
Height	24 mm (0.94") module projects 17 mm (0.67")
Weight	10 g (0.022 lbs.)

Block Diagram TB807



A.4 TB810/TB811 ModuleBus Optical Port

Features

- 1 fiber optic port for the Optical ModuleBus expansion
- ModuleBus (electrical) connection to the CI810/CI830, FCI and TB815.

Description TB810

The TB810 ModuleBus Optical Port is a communication interface between the CI810 FCI electrical ModuleBus and the TB820 ModuleBus Modem of an I/O cluster or ABB drives units via the Optical ModuleBus.

The TB810 can be used in both a simplex optical configuration as well as in a duplex optical configuration. In a simplex configuration, the optical Modulebus nodes are connected in a ring. In a duplex configuration, the optical Modulebus nodes are connected in a row.

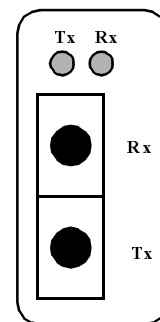
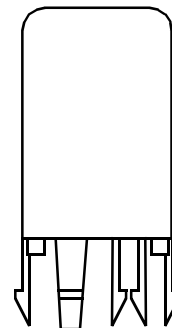
The TB810 has two connectors for fiber optic connections and a connection to the communication interface module. The module is equipped with Transmitter/Receiver for up to 10 Mbit/s. Both plastic and HCS (Hard Clad Silica) optic fiber with connectors (HP Versatile Link) can be used with the TB810.

Description TB811

The TB811 ModuleBus Optical Port is a communication interface between the FCI electrical ModuleBus and the ABB drives units via the Optical ModuleBus.

The TB811 can be used in a simplex optical ring configuration.

The TB811 has two connectors for fiber optic connections and a connection to the communication interface module. The module is equipped with Transmitter/Receiver for up to 5 Mbit/s. Plastic and optic fiber with connectors (HP Versatile Link) can be used with the TB811.



Technical Data

Table A-6. TB810 ModuleBus Optical Port Specifications

Item	TB810	TB811
Application	S800 I/O clusters and ABB variable drives	ABB variable drives
Configuration	Simplex and duplex	Simplex
Fibers	Plastic and HCS (Hard Clad Silica)	Plastic
Connector	HP Versatile Link	HP Versatile Link
Optical ModuleBus	Fiber optic interface, one transmit and one receive connection for max. 10 Mbit/s.	Fiber optic interface, one transmit and one receive connection for max. 5 Mbit/s.
Indicators	Tx LED: Yellow indicates transmitting of data on the optical ModuleBus Rx LED: Yellow indicates receiving of data on the optical ModuleBus	Tx LED: Yellow indicates transmitting of data on the optical ModuleBus Rx LED: Yellow indicates receiving of data on the optical ModuleBus
Current consumption +5V	100 mA	100 mA
Current consumption +24V	20 mA	20 mA
Power dissipation	0.5 W	0.5 W
Safety Classification	Class I according to IEC 536; (earth protected)	Class I according to IEC 536; (earth protected)
Protection Rating	IP20 according to IEC 529, (IEC 144)	IP20 according to IEC 529, (IEC 144)
Rated insulation voltage	50V	50V
Dielectric test voltage	500V a.c.	500V a.c.
Width	20 mm (0.79")	20 mm (0.79")
Depth	39.6 mm (1.6")	39.6 mm (1.6")
Height	39.6 mm (1.6")	39.6 mm (1.6")
Weight	19 g (0.042 lbs.)	19 g (0.042 lbs.)

Connections

Table A-7. Optical ModuleBus Connections (X2)

Port	Duplex Signals	Simplex Signals
Tx	Transmit data to down-stream device	Transmit data to next device
Rx	Receive data from up-stream device	Receive data from last device

Opto cable for TB810 according to HP

Plastic Optical Fiber (POF) up to 15 meters.

- Extra low loss attenuation
- Simplex or duplex cable
- Latching simplex or duplex connector.

Hard Clad Silica (HCS) fiber up to 200 meters.

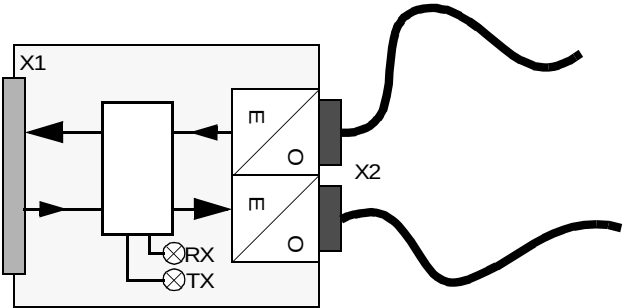
- Riser or plenum
- Simplex cable
- Standard simplex connector.

Opto cable for TB811 according to HP

Plastic Optical Fiber (POF) up to 10 meters.

- Extra low loss attenuation
- Simplex cable
- Latching simplex connector.

Block Diagram TB810/TB811



A.5 TB820 ModuleBus Modem

Features

- 2 fiber optic ports to optical ModuleBus
- ModuleBus (electrical) to the I/O Modules
- Supervisory functions of I/O ModuleBus and power supply
- Isolated power supply to I/O modules
- DIN rail mounting.

Description

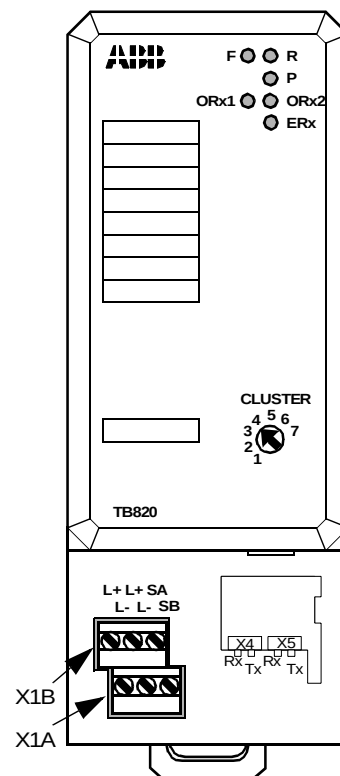
The TB820 ModuleBus Modem is a communication interface for connection of S800 I/O modules via the optical and electrical ModuleBus.

The TB820 can be used in both a simplex optical configuration as well as in a duplex optical configuration. In a simplex configuration, the optical Modulebus nodes are connected in a ring. In a duplex configuration, the optical Modulebus nodes are connected in a row.

TB820 has two basic parts: Module termination board and the power supply/communications board (see block diagram).

The termination board is a unit where most of the connections to the outside takes place. It is grounded to the DIN-rail through a metallic spring connector. The board carries screw terminals for power supply and redundant power supply monitoring, connector for the electrical Modulebus, a current limit “fuse” for the +24V supply of the I/O modules and the electrical Modulebus.

The power supply board has an isolated power converter that generates a short circuit proof +5V supply for the TB820 and connected I/O modules. This board also contains the Modulebus interfaces, LED indicators and one screwdriver maneuvered rotary switch for the Modulebus I/O cluster address. The Modulebus I/O cluster address (1-7) is set by a rotary decimal code switch, any other value than 1-7 is not allowed and will turn the Run LED off.



The Modulebus has an electrical and an optical interface which are logically the same bus. A maximum of twelve I/O modules can be connected to the electrical Modulebus and up to seven clusters can be connected to the fiber optic Modulebus expansion. The fiber-optical interface is intended for local distribution of I/O clusters and where more than 12 I/O modules per station are required. Any distribution of I/O modules across the base cluster and the remote cluster(s) is allowed, however not more than 24 I/O modules per station can be used.

The module is equipped with optical Transmitter/Receiver for up to 10 Mbit/s. Both plastic and HCS (Hard Clad Silica) optic fiber with connectors (HP Versatile Link) can be used with TB820.

Technical Data

Table A-8. TB820 ModuleBus Modem Specifications

Item	Value
Power input	24V d.c. (19.2 - 30)
Power consumption at 24V d.c.	100 mA
Power dissipation	2.4 W
Power supply monitoring inputs	Max. input voltage: 30V Min. input voltage for high level: 15 V Max. input voltage for low level: 8 V
Power output (ModuleBus)	24V max. = 1.5A 5V max. = 1.25A
Electrical ModuleBus	Maximum of 12 I/O modules
Optical ModuleBus Fiber optic interface, two transmitters and two receivers for	Maximum of 7 I/O clusters Max. 10 Mbit/s

Table A-8. TB820 ModuleBus Modem Specifications (Continued)

Item	Value
Indicators	R(un) LED: Green indicates that the TB820 is operational F(ault) LED: Red indicates a fault condition; Reset and communications errors on the electrical ModuleBus turns the LED on. P(owok) LED: Green indicates that the d.c./d.c. converter generates a valid +5V d.c. ORx1 and ORx2 traffic LEDs: Yellow (blinking) indicates that the TB820 is receiving data on the two optical ModuleBus channels respectively. ERx traffic LED: Yellow (blinking) indicates the TB820 is receiving data on the electrical ModuleBus. It also indicates that the electrical Modulebus channel is supervised.
Safety Classification	Class I according to IEC 536; (earth protected)
Protection Rating	IP20 according to IEC 529, (IEC 144)
Rated insulation voltage	50V
Dielectric test voltage	500V a.c.
Width	58 mm (2.39")
Depth	122 mm (4.8")
Height	170 mm (6.7") including latch
Weight	0.3 kg (0.66 lbs.)

Connections

Table A-9. Power Supply Connections

Pin	Designation	Description
X1B - 1	L+	+24V d.c. Supply In
X1B - 2	L+	+24V d.c. Supply Out
X1B - 3	SA	Redundant Power Supply "A" Monitoring Input
X1A - 1	L-	0V d.c. Supply In
X1A - 2	L-	0V d.c. Supply Out
X1A - 3	SB	Redundant Power Supply "B" Monitoring Input

Table A-10. Optical ModuleBus Connections (X4, X5)

Port	Duplex Signals	Simplex Signals
X4 - Tx	Transmit data to down-stream device	Transmit data to next device
X4 - Rx	Receive data from down-stream device	Not used
X5 - Tx	Transmit data to up-stream device	Not used
X5 - Rx	Receive data from up-stream device	Receive data from last device

Opto connectors type HP Versatile Link can handle both plastic and HCS optic fiber.

Opto cable according to HP

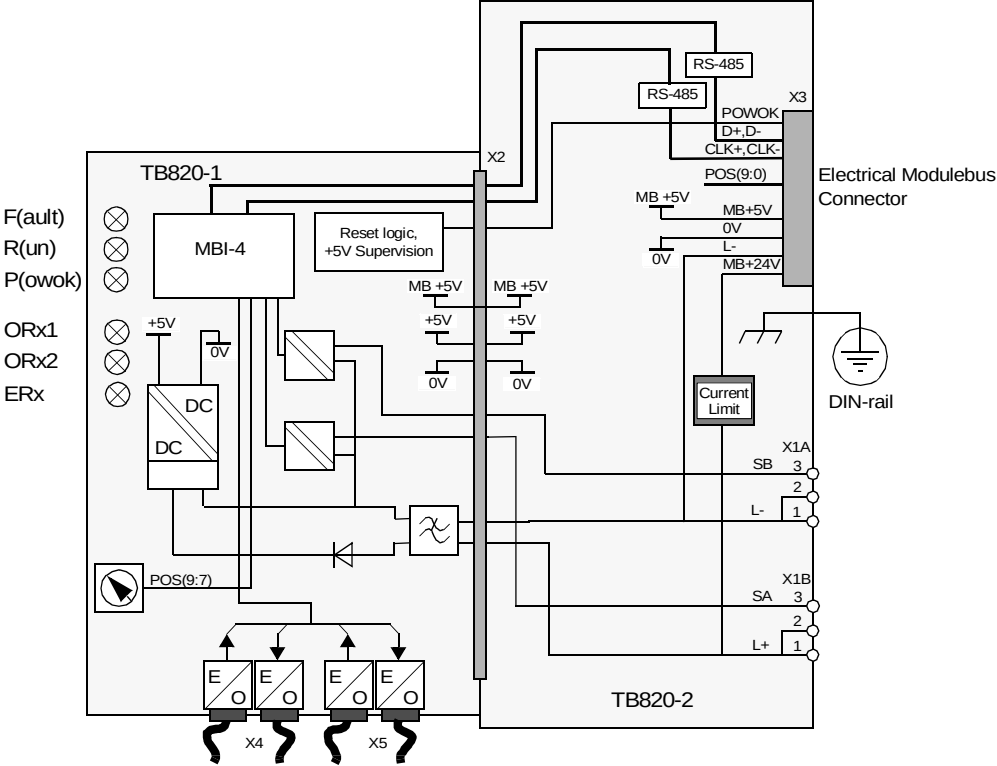
Plastic Optical Fiber (POF) up to 15 meters.

- Extra low loss attenuation
- Simplex or duplex cable
- Latching simplex or duplex connector.

Hard Clad Silica (HCS) fiber up to 200 meters.

- Riser or plenum
- Simplex cable
- Standard simplex connector.

Block Diagram TB820



Appendix B References

B.1 Power Up on S800 I/O

S800 I/O will start under four different conditions.

1. Without configuration and without communication with the controller. Start the first time or after a long power off.
2. Without configuration but with communication with the controller. Start the first time or after a long power off.
3. With configuration but without communication with the controller. Start after a short power off.
4. With configuration and with communication with the controller. Start after a short power off.

Below follows a description how to start and how S800 behaves during start-up under different conditions.

1. Check that the circuit breakers on the power switch units are switched off.
2. Switch on the mains power, and check for correct mains voltage with a multimeter.
3. Switch on the circuit breaker on the power switch unit(s).

Without configuration and without communications with the controller:
See timing diagram Figure 2-1.

Indications on FCI

F (fault)	“on” at power up and “off” after self-test ok
R (run)	“off”
P (pow ok)	“on” if power supply ok
T1	“off”
T2	“off”
PR	“on” (only primary FCI in a redundant configuration)
DU	“off” (both FCI in a redundant configuration).

Indications on I/O modules

F (fault)	"on"
R (run)	"off"
W (warning)	"off"
O (osp only outputs)	"off"

Without configuration but with communications with the controller:
See timing diagram Figure 2-2.

Indications on FCI

F (fault)	"on" at power up and "off" after self-test ok
R (run)	"off" at power up and "on" after configuration ok and commanded operational from the controller (can take about 1 to 4 minutes)
P (pow ok)	"on" if power supply ok
T1	"on" if cable 1 ok
T2	"on" if cable 2 ok
PR	"on" (only primary FCI in a redundant configuration)
DU	"off" (both FCI in a redundant configuration)

The backup will be started up after the I/O. When the backup has started

PR	"on" (only primary FCI in a redundant configuration)
DU	"on" (both FCI in a redundant configuration)

Indications on I/O modules

F (fault)	"on" at power up and "off" after the first access from the FCI
R (run)	"off" at power up and "on" for AI, DI after configuration and for AO, DO after configuration and commanded operational from the controller
W (warning)	"off" at power up and after module operational updated from the module
O (outputs only)	"off" at power up and after module operational updated from the module

With configuration but without communications with the controller:
See timing diagram Figure 2-3.

Indications on FCI

F (fault)	"on" at power up and "off" after self-test ok
R (run)	"off"
P (pow ok)	"on" if power supply ok
T1	"off"
T2	"off"
PR	"on" (only primary FCI in a redundant configuration)
DU	"off" (both FCI in a redundant configuration)

Indications on I/O modules

F (fault)	"on" at power up and "off" after the first access from the FCI
R (run)	"off" at power up and "on" for AI, DI after configuration from the FCI. AO and DO remains in "off"
W (warning)	"off" at power up and after module operational updated from the module
O (osp only outputs)	"off"

With configuration and communications with the controller:
See timing diagram Figure 2-4.

Indications on FCI

F (fault)	"on" at power up and "off" after self-test ok
R (run)	"off" at power up and "on" after configuration and commanded operational from the controller. (can take about 1 to 4 minutes)
P (pow ok)	"on" if power supply ok
T1	"on" if cable 1 ok
T2	"on" if cable 2 ok
The backup will be started up after the I/O. When the backup has started	
PR	"on" (only primary FCI in a redundant configuration)
DU	"on" (both FCI in a redundant configuration)

Indications on I/O modules

F (fault)	"on" at power up and "off" after the first access from the FCI
R (run)	"off" at power up and "on" for AI, DI after configuration and for AO,DO after configuration and commanded operational from the controller
W (warning)	"off" at power up and after the module operational updated from the module
O (osp only outputs)	"off" at power up and after module is operational it is handled by the module

Power up of backup FCI in a running system
See timing diagram Figure 2-5.

Indications on FCI

Primary	
F (fault)	"off"
R (run)	"on"
P (pow ok)	"on"
T1	"on"
T2	"on"
PR	"on"
DU	"off" (on when the backup is running)
Backup	
F (fault)	"off"
R (run)	"off" (on when the backup is running)
P (pow ok)	"on"
T1	"on"
T2	"on"
PR	"off"
DU	"off" (on when the backup is running)

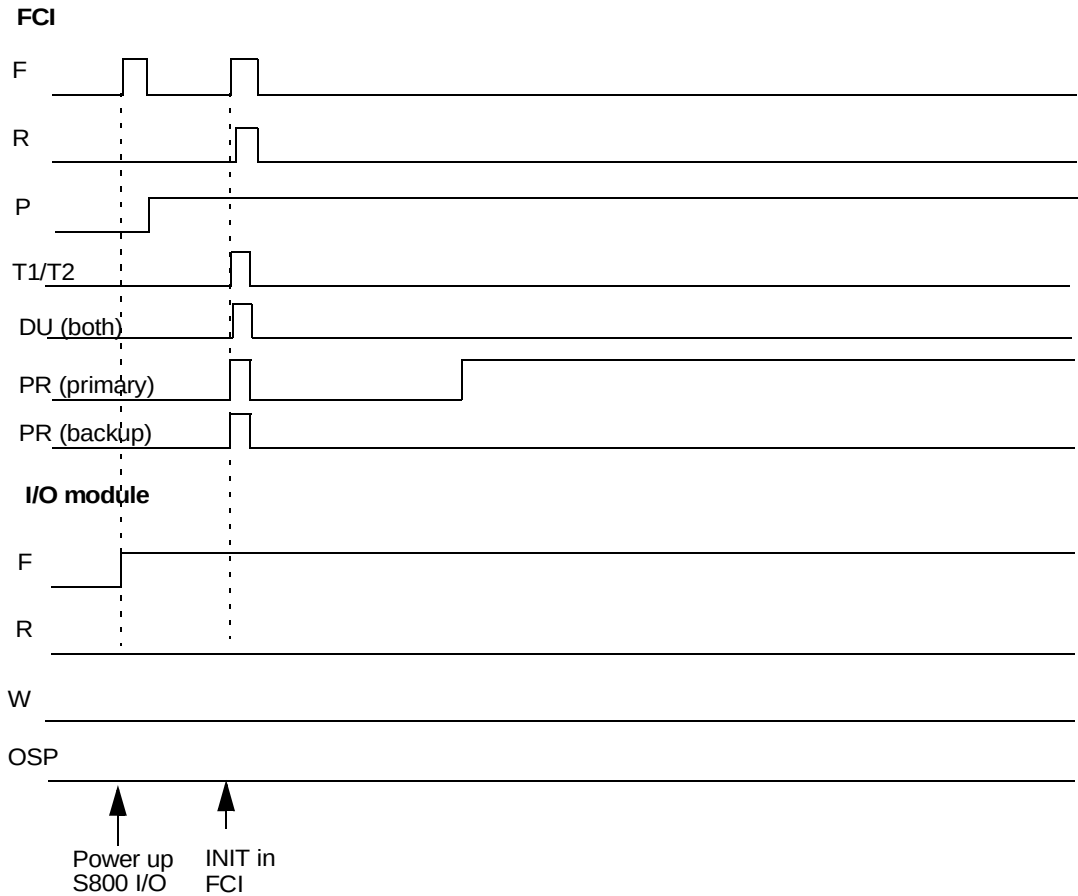


Figure 2-1. Power-up Timing Diagram, No Configuration and No Communications to Controller

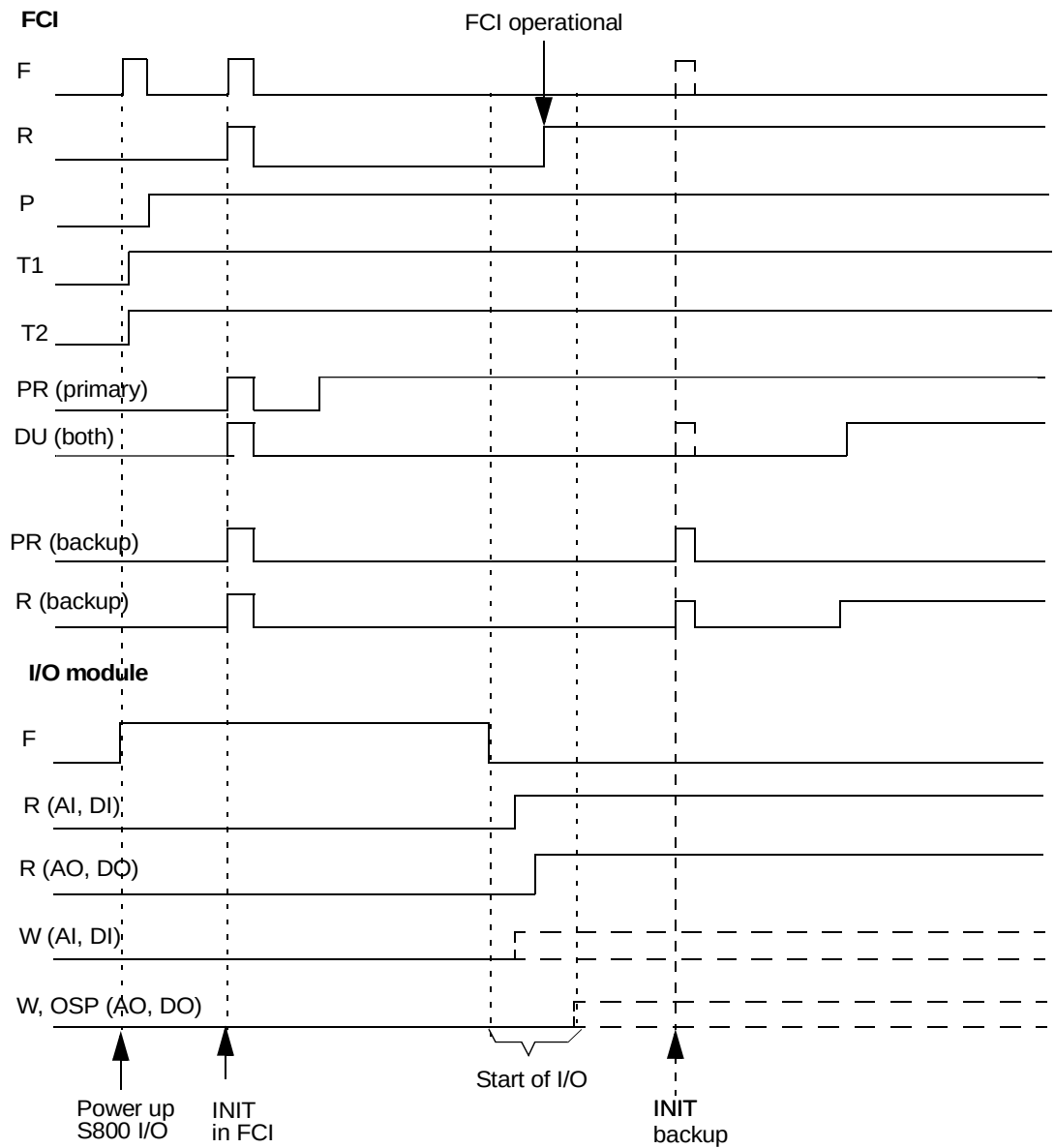


Figure 2-2. Power-up Timing Diagram, No Configuration and Communications to Controller

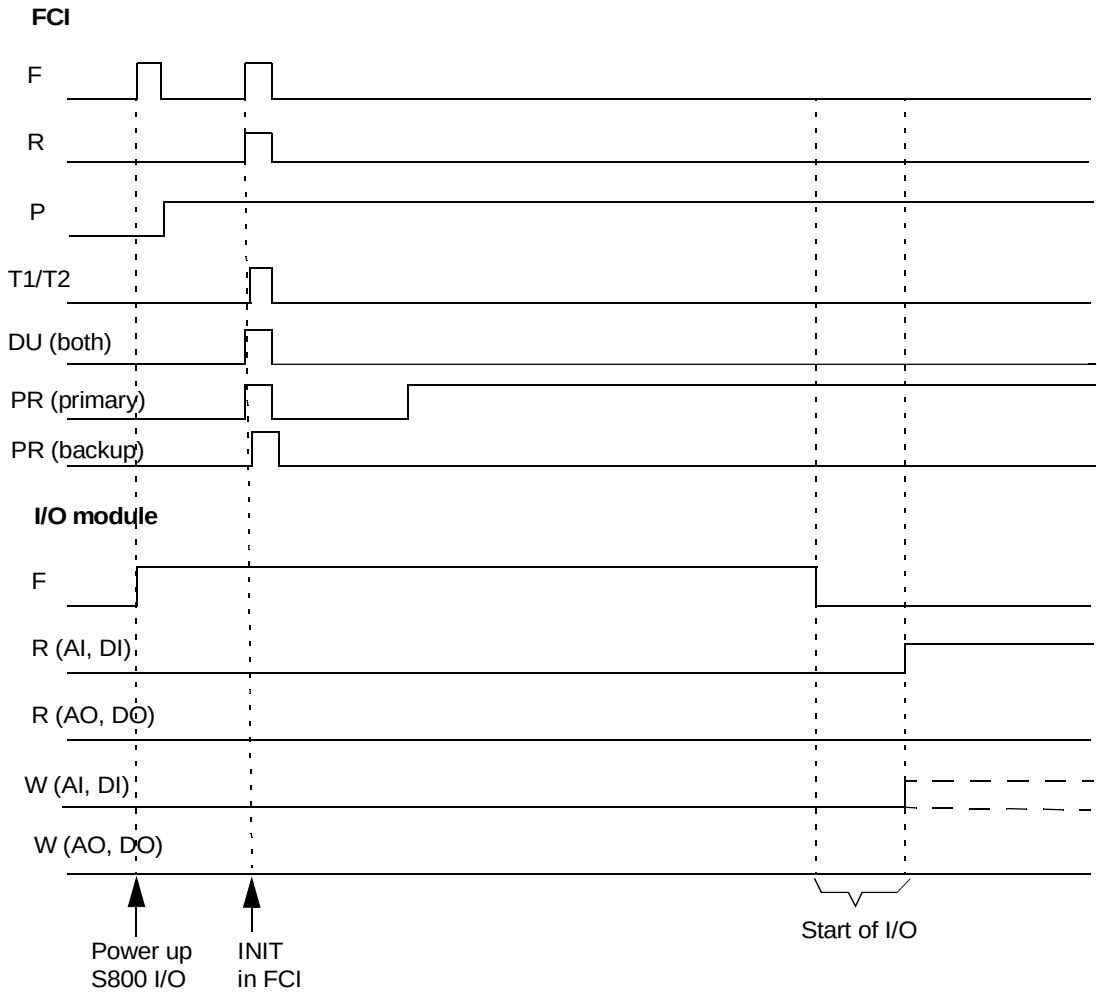


Figure 2-3. Power-up Timing Diagram, With Configuration and No Communications to Controller

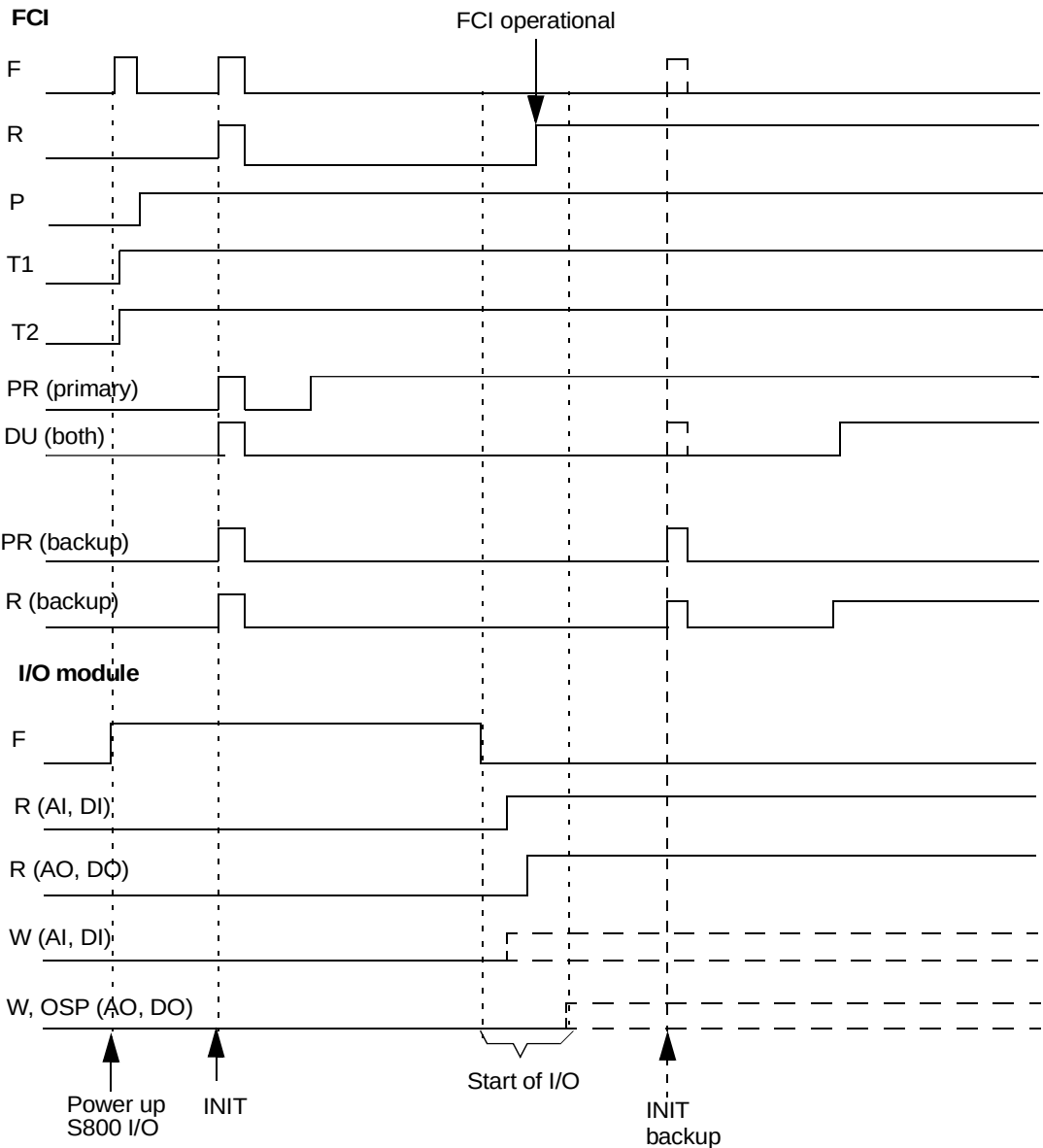


Figure 2-4. Power-up Timing Diagram, With Configuration and Communications to Controller

FCI

Primary

F

R

P

T1/T2

PR

DU

Backup

F

R

P

T1/T2

PR

DU

Power-up
backup

INIT
backup

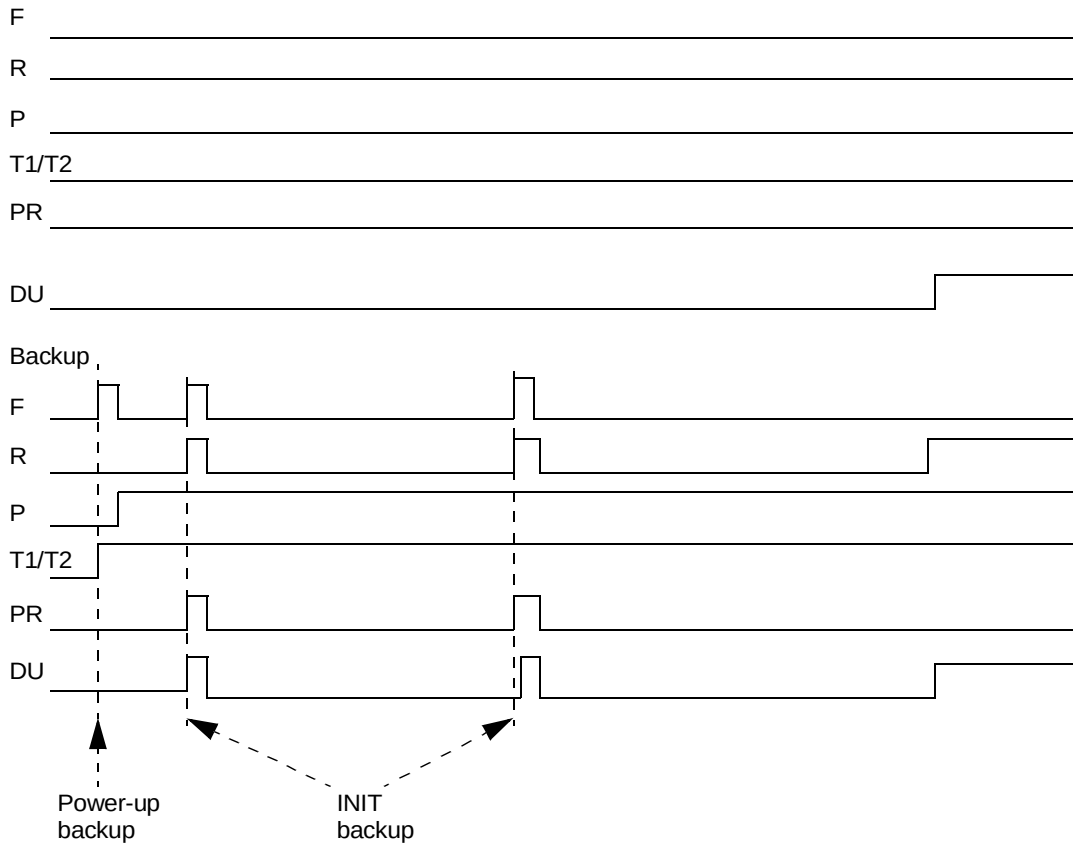


Figure 2-5. Power-up Timing Diagram, Power-up of Backup in a Running System

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